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ABSTRACT

This document describes the steps to be followed in the development of a prescription manual for training of water treatment plant operators. Suggestions on how to prepare both flow and narrative prescriptions are provided for a variety of water treatment systems, including: raw water, flocculation, rapid sand filter, caustic soda feed, alum feed, chlorination and fluoridation. (CS)

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CLEMSON UNIVERSITY

Environmental Systems Engineering

DEVELOPMENT OF A WATER TREATMENT PLANT OPERATION MANUAL USING AN ALGORITHMIC APPROACH

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U.S. DEPARTMENT OF HEALTH EDUCATION & WELFARE
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DEVELOPMENT OF A WATER TREATMENT PLANT OPERATION MANUAL USING AN ALGORITHMIC APPROACH

by

Cary A. Counts

Special Problem

Environmental Systems Engineering

Clemson University

August 1972

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INTRODUCTION

The day of the untrained and unskilled water treatment plant is over. The widespread use of automatically controlled and monitored processes and the growing complexity of water treatment caused by the pollution of many surface water sources make highly qualified and knowledgeable water utility operators an absolute necessity, a necessity that will increase in the future along with our increasing need for clean water.

In order to be capable of managing a modern water treatment plant efficiently, an operator must be thoroughly familiar with its processes and equipment. Such knowledge is most easily and ecomonically acquired through some planned form of operator training, but unfortunately very little attention has traditionally been given to this need. While a number of manufacturer's equipment manuals, conventional textbooks, and correspondence courses do exist, most of them are too general and too theoretical to be of help to the average operator. Nor does every actual or potential operator have access to a training course offered by a technical institution. What is needed, and has not been available, is an operationally oriented training tool for those specific plant processes and equipment which the trainee will be required to operate. This material should be usable by an individual where few or no qualified instructors are available, when little time can be spent on training, and where a high degree of operational competency is demanded. The author hopes to demonstrate that this void can be filled by training materials such as this manual.

A brief description of the most common operator training method now

being used might be of value here, in order to emphasize the need for an improved technique. In most plants training is accomplished by putting a new trainee on the job with an experienced and supposedly capable operator. The "old hand" shows the trainee how the equipment works and explains the processes. The success of this method depends upon many factors, including (but not limited to) the following: 1) the experienced operator's understanding of the equipment and processes; 2) his ability to explain his knowledge clearly and effectively; 3) his willingness to do a thorough training job; 4) the trainee's understanding of his instructor's explanations; 5) his willingness and ability to enter into the educational process by asking questions, making sure explanations are understood, and so forth; and 6) the ability of the trainee to remember accurately the many details he is told. This method may or may not accomplish its purpose -- to turn the trainee into a capable operator. It is certainly one of the least efficient and least economical methods that could be devised, both because of the time the experienced operator must devote to the process, the time wasted through inefficient presentation of the material to be learned, and the inability of most trainees to accurately assimilate a barrage of frequently confusing verbal instructions. In fact, during the development of this manual, the author talked at length with several competent operators to gather the operational information upon which the manual is based. In nearly every case the operators, though knowledgeable and experienced, were unable to communicate their knowledge effectively. Such communication, to be most useful, requires specialized educational skills which are not analogous with operating skills, and which are simply

not within the powers of most operators, efficient and well trained though they may be.

This method of on-the-job training can result in frustration for the trainee as well as poor plant operation. Frequently, for instance, the demand for a new operator is so great that the trainee is given only a minimum amount of time with an experienced operator and is then pushed into a "sink or swim" operating situation. The most highly motivated person will become frustrated when expected to perform a job for which he has been inadequately prepared. At the other extreme, an unfortunate situation can occur when the demand for a new operator is not pressing. The trainee ends up tagging along with the trainer for so long that he becomes thoroughly bored with the job. Another undesirable situation occurs when a new operator on the job is confronted with an abnormal operating condition which did not occur during his training period. As he is unprepared to cope with this, a period of poor plant operation ensues while he determines the corrective procedure and takes the necessary corrective action.

An instructional guide to the operation of a water treatment plant such as that described and demonstrated in the pages which follow can greatly improve the quality of operation produced by a trainee or new operator as well as reduce the need for training by an experienced operator. While a certain amount of orientation by an "old hand" may add to the trainee's security and self confidence, the bulk of the guidance needed can come from the easily followed training guides written specifically for the plant being operated. In addition, the guides can serve as reference materials until the skills they teach have been thoroughly assimilated by the trainee.

STRUCTURE

A *flow prescription* or *algorithmic* form was adopted for the development of this manual because it has been deomonstrated that this technique offers the simplest, easiest to follow, and most error-proof method of instruction for a trainee with little or no previous knowledge of the actions being performed (Morabin, 1970). A *flow prescription* or *algorithm* is an orderly procedure or exact method for solving a problem. It leads the user from a collection of input data to the desired result through a succession of small, directed steps. In a prescription, the user responds to simple questions, working only through those questions which are relevant to his task. He does not need to remember input data, rules, or decisions to complete the process, these factors being supplied by the prescription. When the appropriate path through the prescription is followed, however, a specification of the proper action to be taken is completed.

An advantage of the flow prescription, or description of the tasks being performed written in a flow chart format, is that extraneous, "nice to know" but inessential information is omitted. This is not to say that the operator will never learn the principles and reasons for the actions he takes. Such knowledge will undoubtedly come as experience increases. However, the flow prescription approach enables the inexperienced operator to perform immediate and accurate operation of the equipment and processes in question, and it does so without expensive and time consuming training techniques.

The value of prescriptions or algorithms in decision making has

been supported by tests reported in "Case Studies in the Use of Algorithms" (Lewis, Horabin, Gane, 1970). The tests compared the abilities of a group of civil servants to interpret and use rules specified both in normal prose form (such as might be found in a textbook or manufacturer's manual) and in a flow prescription or algorithm. Results showed that the flow prescription form led to significantly quicker and more accurate problem solving than did the prose version. Flow prescriptions are coming into increasing use by governmental and public agencies as well as by those who must operate complex machinery and equipment, because they are easy and quick to use and produce reliable and consistent results.

In this manual a stimulus-response technique was used to develop the flow prescriptions. This technique insures that no action in the operation procedure is omitted, as each response is given in answer to a stimulus, and each stimulus follows in order as a result of the previous response. Examples of this technique can be seen in the flow prescriptions located in Appendix II.

Reduction of the flow prescriptions of this manual to simplified prose versions (plant guides) was undertaken because the flow prescriptions tended to be long and cumbersome due to the multitude of input data required for some of the processes. The simplified prose form condenses the flow prescription greatly and presents the steps in a more familiar and easily readable form. The user starts with step one in each process and follows the flow prescription according to the factors in his particular task, making sure that he proceeds to the next step specified at the end of the action just completed.

This guide was prepared for the Seneca Water Treatment Plant, Seneca, South Carolina, and its intent is to record a standardized procedure for the routine, normal operation of this plant. No attempt has been made to analyze and prescribe the actions required when abnormal conditions exist in either the treatment process or the raw water source, although abnormal operating procedures would be included in a complete plant guide, as would corrective maintenance procedures.

The flow and narrative prescriptions are included so that the reader may see the progression of steps which led to the *plant guide*. The prescriptions would not be included in a training manual.

DEVELOPMENT

Figure 1 is a flow prescription showing the steps in the development of the complete operation manual. A systematic approach was adopted, in which the author attempted to identify every detail (many of them quite minute) in the operation of each process. Each action was then recorded in the proper sequence on the flow prescription. This insured that all the actions, whether obvious or not, performed by an experienced operator would be included in the training material to be used by inexperienced operating personnel.

The flow chart format of the flow prescription brings all of the necessary functions required of the operator into an easily read diagrammatic display. This helps the developer to see the places in the prescription where additional information is needed, where a step may have been inadvertently omitted, or where the writer needs to be more specific in his description.

The initial version of the prescription attempts to include all of the actions of the operator relevant to the process being described, but it is probably impossible to write a completely accurate prescription in one attempt. As the prescription continues toward completion, the correction of errors which become apparent finally results in a prescription which includes as many of the operational skills required by the task in question as possible.

The second step in development of the manual is the writing of the *narrative prescription*, which consolidates the steps of the flow prescription into a more easily read form. The narrative prescription

retains the stimulus-response technique of the flow prescription in order to insure that no action is omitted. Although the narrative prescription is long and cumbersome, this step is valuable as a further error-checking mechanism. For clarity, the steps in the narrative prescription are numbered in sequence.

The first two steps (the flow prescription and narrative prescription) were employed by Louis D. Eckley in his development of a training guide for the operation of a screening-grinding device in a wastewater treatment plant, and by Barry W. Peterman in his training manual for wastewater facility operators.

An additional more compact and simplified prose version of the prescription is included in this manual, called the *simplified plant guide*. As experience is gained in developing manuals using the procedure just described, the narrative prescription might be eliminated, with development proceeding directly from the flow prescription to the simplified plant guide.

The simplified plant guide abandons the stimulus-response approach and reduces the lengthy narrative prescription to an orderly and nonrepetitive list of actions to be performed by the operator. The instructions and language of the plant guide presuppose no specialized training or knowledge of nomenclature of hardware or instructional technology terms on the part of the user. The steps are numbered in the sequence of use and at the end of each step the next step is indicated.

It is hoped that further improvement will be made in a manual of this type by those who use it. Its design was planned to allow additions, deletions, and modifications, and some of these may be necessary

for the manual to achieve its objective: the training of capable and efficient water plant operators.

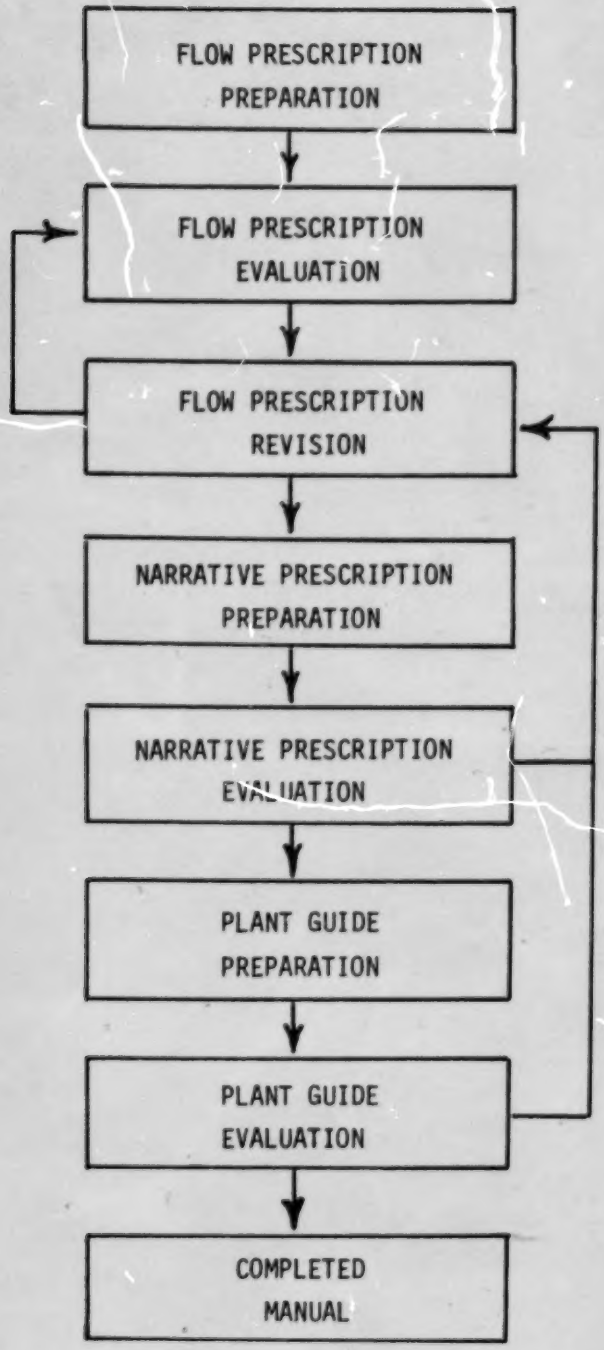

Figure 1. Steps in the Development of a Complete Operation Manual (Modified from Peterman, 1971)

SIMPLIFIED PLANT GUIDES

RAW WATER SYSTEM AND INTAKE STRUCTURE
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the raw water pumping system.

ACTION:

1. Look at the illuminated lights on the control panel to determine which pumps are operating (a pump is operating if its green "ON" button is illuminated). On the inspection report, note which pumps are operating. Go to STEP 2.

2. Look at the plant operation log to determine whether pumps require shifting.

   a. If proper pump is not in operation and pumps require shifting, go to STEP 3.

   b. If proper pump is operating, skip to STEP 5.

3. Locate START-STOP buttons for the raw water pumps on the control panel, and press the STOP switch for the pump which is operating. Go to STEP 4.

4. Press the START switch for the pump which should be operating.

5. Look at the control panel to see whether the proper light is illuminated for the pump which is operating.

   a. If the proper light is not illuminated, go to STEP 6.

   b. If the proper light is illuminated, skip to STEP 7.

6. Record the malfunction on the inspection report. Go to STEP 7.

7. Go to the intake structure and locate pump #1. Go to STEP 8.

8. Look at the coupling between the motor and the pump to determine whether the pump is operating. (The pump is operating if the coupling is turning.) Go to STEP 9.

9. Refer to the inspection report to determine whether the actual operational status of the pump corresponds to the operational status indicated by the illuminated lights on the control panel.

   a. If operational status does not correspond, go to STEP 10.

   b. If operational status does correspond, skip to STEP 11.

10. Note on the inspection report the discrepancy between actual operational status and status indicated by control panel lights. Go to STEP 11.

11. Locate the oil level indicator window on the upper left side of the pump motor to determine whether the oil is above, on, or below the fill line.

a. If the oil level is on or below the fill line, go to STEP 12.

b. If the oil level is above the fill line, go to STEP 15.

12. Get proper weight oil from the supply room. Information about the weight of oil to use can be found in the manufacturer's manual for the pump which is filed under RAW WATER PUMPS in the filing cabinet in the main control room. Go to STEP 13.

13. Prepare to add oil to the reservoir of the pump by removing the plug from the fill hole on top of the reservoir (turn the plug counter-clockwise with a 1/4" Allen wrench). Go to STEP 14.

14. Add oil until its level is approximately 1 inch above the fill line and replace the plug. Go to STEP 15.

15. Look at the inspection report to determine whether both raw water pumps have been inspected.

a. If not, go to the pump which has not been inspected, and return to STEP 8.

b. If both have been inspected, go to STEP 16.

16. Look at the intake opening gate cranks located behind the raw water pumps and determine which intake opening is being used. (A gate is open when the threaded shaft reaches the top of the clear plastic housing above the crank wheel.). Go to STEP 17.

17. Look at the water level in the lake to determine whether the intake opening in use is above the water level.

a. If the intake opening is above the water level, go to STEP 18.

b. If the intake opening is below the water level, skip to STEP 21.

18. Look over the side of the intake structure to determine which intake opening should be in use. The intake opening to be used should be completely submerged, and any opening which is either partially or completely above the water surface should be closed. Go to STEP 19.

19. Raise the gate over the opening to be used by turning its crank wheel (located on top of the intake structure) clockwise until the threaded shaft reaches the top of the clear plastic housing. Go to STEP 20.

20. Close the previously used intake opening by turning its crank wheel counter-clockwise as far as possible. Go to STEP 21.

21. Routine inspection of the raw water pumping system completed.

FLASH MIXER
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the flash mixer.

ACTION:

1. Look at the control panel to determine the operational status of the flash mixer (the operational status is indicated by an illuminated START or STOP light). Go to STEP 2.

2. Look at the mixer drive motor to determine whether the flash mixer is actually operating (the mixer is operating if the motor shaft is turning). Go to STEP 3.

3. Determine whether the actual operational status of the mixer is correctly indicated by the illuminated lights on the control panel:

   a. If the green START light is illuminated but the motor shaft is not turning, go to STEP 4.

   b. If the red STOP light is illuminated but the motor shaft is turning, go to STEP 5.

   c. If the red STOP light is illuminated and the motor shaft is not turning, go to STEP 6.

   d. If the green START light is illuminated and the motor shaft is turning, skip to STEP 7.

4. Notify maintenance of the malfunction, note malfunction on inspection report, and skip to STEP 13.

5. Note malfunction on inspection report and go to STEP 7.

6. Locate on the control panel the green button marked FLASH MIX START; press the button to start the mixer, then return to STEP 3.

7. Look at the gear reducer housing on the mixer motor and locate the oil level indicator opening which is fitted with a square head screw plug. Go to STEP 8.

8. Remove the plug by turning the screw counter clockwise with an adjustable wrench. Go to STEP 9.

9. Look at the opening to observe whether any oil trickles out:

   a. If oil does not trickle from the opening, go to STEP 10.

   b. If oil does trickle from the opening, skip to STEP 12.

10. Get proper weight oil from the supply room. Information about the weight of oil to be used is found in the manufacturer's manual for the motor which is filed under FLASH MIXER in the filing cabinet in the main control room. Go to STEP 11.

11. Add oil through the indicator opening until it trickles out when the oil can spout is removed from the opening. Go to STEP 12.

12. Replace the plug by inserting the screw into the opening and turning it clockwise. Tighten the plug with the adjustable wrench until no oil escapes. Go to STEP 13.

13. Routine inspection of the flash mixer completed.

FLOCCULATORS

SIMPLIFIED - PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the flocculators.

ACTION:

1. Look at the illuminated lights on the control panel labelled FLOCCULATORS to determine whether flocculators are operating (a flocculator is operating if its green START button is illuminated). Go to STEP 2.

2. Note on the inspection report which flocculator lights are illuminated. Go to STEP 3.

3. Go to flocculator #1 and determine whether it is actually operating (it is operating if the paddle is turning). Go to STEP 4.

4. Determine whether the actual operating status of the flocculator corresponds to the operational status indicated by the lights on the control panel:

   a. If the green START light is illuminated but the paddle is not turning, report the malfunction to maintenance, note malfunction on inspection report, and go to STEP 7.

   b. If the red STOP light is illuminated but the paddle is turning, go to STEP 5.

   c. If the green START light is illuminated and the paddle is turning, go to STEP 7.

   d. If the red STOP light is illuminated and the paddle is not turning, go to STEP 6.

5. Notify maintenance of malfunction, note malfunction on inspection report, and go to STEP 7.

6. Locate the green FLOCCULATOR START button on the control panel and press the button to start the flocculator, then go to STEP 7.

7. Look at the inspection report to determine whether any flocculators remain to be inspected:

   a. If flocculator #2 remains to be inspected, go to STEP 8.

   b. If both flocculators have been inspected, return to flocculator #1 and go to STEP 9.

8. Go to flocculator #2 and determine whether it is actually in operation, then return to STEP 4.

9. Locate the flocculator drive motor on the deck beside the flocculator basin. Look at the gear reducer housing on the drive motor and locate the oil level indicator opening which is fitted with a square head screw plug. Go to STEP 10.

10. Remove the plug by turning the screw counterclockwise with an adjustable wrench. Go to STEP 11.

11. Look at the oil level indicator opening to determine whether any oil trickles out:

    a. If oil does not trickle from opening, go to STEP 12.

    b. If oil does trickle from opening, skip to STEP 15.

12. Get proper weight oil from the supply room. Information about the proper weight oil to use can be found in the manufacturer's manual for the motor which is filed under FLOCCULATORS in the filing cabinet in the main control room. Go to STEP 13.

13. Add oil through the indicator opening until it trickles out when the oil can spout is removed. Go to STEP 14.

14. Replace the plug by inserting the square head screw into the opening and turning it clockwise. Tighten the plug with a six inch adjustable wrench until no oil escapes:

    a. If the oil level in both flocculator drive motors has not been checked, go to the remaining flocculator and return to STEP 9.

    b. If the oil level in both floculator drive motors has been checked, go to STEP 15.

15. Routine inspection of the flocculators completed.

RAPID SAND FILTERS
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Rapid sand filters.

ACTION:

1. Silence the headloss alarm buzzer and determine which filter has excess headloss by looking for illuminated LOSS OF HEAD lights on the control panel. Go to STEP 2.

2. Determine if actual excess headloss condition exists in the filter by reading the measured headloss from the HEADLOSS INDICATOR CHART (excess headloss exists when the loss is seven or more feet):

   a. If headloss is less than seven feet, go to STEP 3.

   b. If headloss is seven feet or more, skip to STEP 4.

3. Notify maintenance of headloss alarm malfunction and skip to STEP 10.

4. Locate on the control panel the green FILTER WASH button for the filter with excess headloss and press this button to start the backwash sequence. Go to STEP 5.

5. On the control panel locate the FILTER WASH MONITOR and follow the backwash sequence by observing the illuminated amber lights on the FILTER WASH MONITOR. (The start of a step in the sequence will be indicated by the illumination of its amber light. The light will be extinguished when the step is completed):

   a. If the backwash sequence continues to completion, skip to STEP 9.

   b. If the backwash sequence does not continue to completion, go to STEP 6.

6. Look beneath the FILTER WASH MONITOR to locate the amber RESTART button, and press this button to begin the next step in the backwash sequence. Go to STEP 7.

7. Determine whether the backwash sequence has restarted by looking at the FILTER BACKWASH MONITOR:

   a. If it has restarted, return to STEP 5.

   b. If it has not restarted, inform maintenance and assist in repairing the malfunction until relieved or repairs are completed; then go to STEP 8.

8. Press RESTART button to start the next step in the backwash sequence; then return to STEP 7.

9. Verify that abnormal condition no longer exists by comparing the status of the LOSS OF HEAD indicator lights with actual headloss conditions in the filters as indicated on the HEADLOSS INDICATOR CHART:

   a. If abnormal conditions still exist, return to STEP 2.

   b. If abnormal conditions no longer exist, go to STEP 10.

10. Actions required for normal operation of rapid sand filters are completed.

FINISHED WATER SERVICE SYSTEM
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the finished water service pumping automatic control system.

ACTION:

1. When the ELEVATED STORAGE TANK WATER LEVEL indicator on the control panel shows that the elevated storage tank is being filled, begin the inspection. Go to STEP 2.

2. Note on inspection report whether service pump #1 or #2 is operating. Go to STEP 3.

3. When the water level in the elevated storage tank has reached 35 feet, look at the control panel and from the illuminated lights determine whether the automatic controller has shut down the service pump that was operating (the pump has been shut down when its green ON light has been extinguished and its red OFF light has been illuminated):

   a. If the pump is not automatically shut down, go to STEP 4.

   b. If the pump is automatically shut down, skip to STEP 6.

4. Locate on the control panel the red OFF button for the service pump that is operating and manually shut down the pump by pressing the OFF button. Go to STEP 5.

5. Notify maintenance of the malfunction in the automatic shutdown portion of the service pump control system. Go to STEP 6.

6. Continue to watch the WATER LEVEL INDICATOR as the water level in the tank falls. When the water level reaches 26 feet, determine from the illuminated lights on the control panel whether the automatic controller starts a service pump (the pump has started when its red OFF light is extinguished and its green ON light is illuminated):

   a. If a pump is not automatically started, skip to STEP 11.

   b. If a pump is automatically started, go to STEP 7.

7. Refer to the inspection report to determine whether the pump now operating is the same one which was used to fill the tank in the beginning of the inspection:

   a. If the same pump did start, go to STEP 8.

   b. If the alternate pump started, skip to STEP 13.

8. Locate on the control panel the red OFF button for the operating pump, and stop the pump by pressing this button. Go to STEP 9.

9. Locate on the control panel the green ON button for the other pump, and start this pump by pressing the ON button. Go to STEP 10.

10. Notify maintenance of the malfunction in the system that automatically

alternates service pump operation, and go to STEP 13.

11. On the control panel locate the green ON button for the pump which was not used to fill the tank at the beginning of the inspection, and manually start this pump by pressing the ON button. Go to STEP 12.

12. Notify maintenance of the malfunction in the automatic start-up portion of the service pump control system. Go to STEP 13.

13. Go to the pump house and locate service pump #1. Go to STEP 14.

14. Look at the oil level indicator window (on the upper left side of the pump motor) to determine whether the oil level is above, on, or below the fill line:

    a. If the oil level is on or below the fill line, go to STEP 15.

    b. If the oil level is above the fill line, skip to STEP 17.

15. Get the proper weight oil from the supply room. Information about the weight of oil to use can be found in the manufacturer's manual for the pump which is filed under SERVICE PUMPS in the filing cabinet in the main control room. Go to STEP 16.

16. Remove the cap of the oil reservoir by turning it counterclockwise by hand, and add oil to the reservoir until the oil level is approximately one inch above the fill line on the oil level indicator window:

    a. If only pump #1 has been inspected, go to STEP 17.

    b. If both pumps have been inspected, skip to STEP 19.

17. Note on inspection report that pump #1 has been inspected. Go to STEP 18.

18. Locate pump #2 and return to STEP 14.

19. Note on inspection report that pump #2 has been inspected. Go to STEP 20.

20. Inspection of the finished water pumping system is completed.

CAUSTIC SODA FEED SYSTEM
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the caustic soda feed system.

ACTION:

1. Look at the illuminated lights on the control panel to determine whether the CAUSTIC SODA FEED PUMP is operating. (The pump is operating if its green ON button is illuminated. It is not operating if the red OFF button is illuminated):
   a. If the pump is not operating, go to STEP 2.
   b. If the pump is operating, skip to STEP 3.
2. Start the pump by pressing its green ON button on the control panel. Go to STEP 3.
3. Read the caustic soda concentration being maintained in the flash mixer from the CAUSTIC SODA FEED INDICATOR dial on the control panel. Note the caustic soda concentration on the inspection report. (This concentration can be read directly in parts per million [ppm] from the scale opposite the dial). Go to STEP 4.
4. Go to the laboratory workbench, turn the faucet handle on the SETTLED WATER sampling tap, and take a 25 milliliter (ml) sample of settled water. Go to STEP 5.
5. Using the HACH DIRECT READING COLORIMETER WATER TESTING KIT located on the laboratory workbench, determine the pH of the water according to the procedure described in the testing kit instruction manual. Go to STEP 6.
6. Note the pH of the water on the inspection report. Go to STEP 7.
7. Determine whether the pH of the water is within the optimum pH range of 7.7 to 7.9:
   a. If the pH of the water is less than 7.7, go to STEP 8.
   b. If the pH of the water is greater than 7.9, go to STEP 10.
   c. If the pH of the water is within the 7.7 - 7.9 range, skip to STEP 11.
8. Go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and turn the dial clockwise to increase the caustic soda concentration by 1 ppm. Go to STEP 9.
9. Wait two hours and take another 25 ml sample from the SETTLED WATER sampling tap, then return to STEP 5.
10. Go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and turn the dial counterclockwise to reduce the caustic soda concentration by 1 ppm. Return to STEP 9.
11. Inspection of the caustic soda feed system completed.

ALUM FEED SYSTEM
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the alum feed system.

ACTION:

1. Look at the illuminated lights on the control panel to determine whether the ALUM FEED PUMP is operating. (The pump is operating if its green ON button is illuminated. It is not operating if its red OFF button is illuminated):

   a. If the pump is not operating, go to STEP 2.

   b. If the pump is operating, skip to STEP 3.

2. Press the green ON button on the control panel to start the pump. Go to STEP 3.

3. Read the alum concentration being maintained in the flash mixer from the ALUM FEED INDICATOR dial on the control panel (this concentration can be read in parts per million [ppm] on the scale opposite the dial) and note this on the inspection report. Go to STEP 4.

4. Go to the flocculator end of the sedimentation basin and look into the water to determine if any white, pea-sized floc particles are suspended in the water:

   a. If floc particles are not suspended in the water, go to STEP 5.

   b. If floc particles are suspended in the water, skip to STEP 8.

5. Locate the fiberglas tank labelled ALUM DAY TANK in the chemical feed room. and look at the sight glass on the right side of the day tank to determine whether the tank contains any alum:

   a. If the day tank does not contain any alum, go to STEP 6.

   b. If the day tank does contain alum, skip to STEP 7.

6. Notify maintenance of a malfunction in the day tank automatic fill system and note the malfunction on the inspection report. Skip to STEP 8.

7. Notify plant supervisor that alum dosage being used does not produce floc and that jar tests should be initiated to determine correct dosage. Go to STEP 8.

8. Routine inspection of the alum feed system completed.

CHLORINATION SYSTEM
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the chlorine feed system.

ACTION:

1. On the laboratory workbench locate the water sampling tap labelled SETTLED WATER. Turn the faucet handle and take a 25 milliliter (ml) sample of the settled water. Go to STEP 2.

2. Locate the HACH DIRECT READING COLORIMETER WATER TESTING KIT on the laboratory workbench and, using the procedure described in the testing kit instruction manual, determine the chlorine concentration in the settled water sample. Go to STEP 3.

3. Note the chlorine concentration on the inspection report and go to STEP 4.

4. Determine whether the chlorine concentration is within the required 0.25 to 0.45 parts per million (ppm) range:

   a. If the chlorine concentration is less than 0.25 ppm, go to STEP 5.

   b. If the chlorine concentration is greater than 0.45 ppm, skip to STEP 15.

   c. If the chlorine concentration is within the 0.25 to 0.45 ppm range, skip to STEP 17.

5. Go to the chlorinator room and locate the chlorinator labelled PRECHLORINATOR. Look at the *rotameter float indicator* to determine whether the maximum allowable prechlorination dose is being used (the maximum prechlorination dose is marked on the rotameter scale and is labelled MAX DOSE):

   a. If the maximum allowable prechlorination dose is not being used, go to STEP 6.

   b. If the maximum allowable prechlorination dose is being used, skip to STEP 8.

6. Locate the DOSAGE RATE CONTROLLER knob on the front of the prechlorinator and increase the rate of prechlorination by turning the dosage rate controller knob clockwise until the rotameter float has risen one scale division. Go to STEP 7.

7. Wait two hours and take another 25 ml sample from the SETTLED WATER sampling tap, then return to STEP 2.

8. Locate the POST CHLORINATOR ON button on the control panel in the main control room, and start the post chlorinator by pressing the button. Go to STEP 9.

9. Locate the POST CHLORINATOR (to the right of the prechlorinator in the

chlorinator room), then look behind the post chlorinator to find the black-handled valve in the chlorine feed line. Open the valve by turning the lever handle counter clockwise until it is parallel to the direction in which the feed line runs. Go to STEP 10.

10. Locate the DOSAGE RATE CONTROLLER knob on the front of the post chlorinator and turn the knob in the direction required to adjust the rotameter float to the first division on its scale. Go to STEP 11.

11. Wait 30 minutes and take a 25 ml sample from the FINISHED WATER SAMPLING TAP, then determine the chlorine concentration in the water by the procedure described in the HACH WATER TESTING KIT INSTRUCTION MANUAL. Go to STEP 12.

12. Note the chlorine concentration on the inspection report and go to STEP 13.

13. Determine whether the chlorine concentration is within the required 0.25 to 0.45 ppm range:

    a. If the chlorine concentration is still below 0.25 ppm, go to STEP 14.

    b. If the chlorine concentration is within the 0.25 to 0.45 ppm range, skip to STEP 17.

14. Return to the chlorination room and increase the chlorine dosage rate by turning the DOSAGE RATE CONTROLLER KNOB clockwise until the rotameter float rises one scale division, then return to STEP 11.

15. Locate the prechlorinator in the chlorinator room. Find the DOSAGE RATE CONTROLLER KNOB on the front of the chlorinator and turn the knob counter-clockwise until the dosage rate has been reduced by one division on the rotameter scale. Go to STEP 16.

16. Wait two hours and take another 25 ml sample from the SETTLED WATER SAMPLING TAP, then return to STEP 2.

17. In the chlorine cylinder storage room locate the constantly weighing scales and note the cylinder weight on the inspection report. Go to STEP 18.

18. Subtract the weight on the scales from the weight noted during the previous inspection. The difference in weights is the weight of chlorine which has been used in the time period between inspections. Note this figure on the inspection report and go to STEP 19.

19. Routine inspection of the chlorine feed system completed.

FLUORIDATION SYSTEM
SIMPLIFIED PLANT GUIDE

NORMAL OPERATING PROCEDURE FOR: Routine inspection of the fluoridation system.

ACTION:

1. Look at the illuminated lights on the control panel to determine whether the FLUORIDE FEED PUMP is operating (the pump is operating if the green ON button is illuminated. It is not operating if the red OFF button is illuminated):
   a. If the pump is not operating, go to STEP 2.
   b. If the pump is operating, skip to STEP 3.
2. Start the FLUORIDE FEED PUMP by pressing its green ON button on the control panel. Go to STEP 3.
3. Read the fluoride concentration being maintained in the flash mixer from the FLUORIDE FEED INDICATOR dial on the control panel, and note this concentration on the inspection report. (This concentration can be read in parts per million [ppm] on the scale opposite the dial). Go to STEP 4.
4. Go to the laboratory workbench, turn the faucet handle on the water sampling tap labelled FINISHED WATER, and take a 25 milliliter (ml) sample of finished water. Go to STEP 5.
5. Using the HACH DIRECT READING COLORIMETER WATER TESTING KIT located on the laboratory workbench, determine the fluoride concentration of the finished water according to the procedure described in the testing kit instructions. Go to STEP 6.
6. Note the fluoride concentration of the finished water on the inspection report. Go to STEP 7.
7. Determine whether the fluoride concentration in the finished water is within the prescribed 0.9 to 1.0 ppm range:
   a. If the fluoride concentration is less than 0.9 ppm, go to STEP 8.
   b. If the fluoride concentration is more than 1.0 ppm, go to STEP 10.
   c. If the fluoride concentration is within the 0.9 to 1.0 range, skip to STEP 11.
8. Go to the FLUORIDE FEED INDICATOR dial on the control panel and turn the dial clockwise to increase by 1 ppm the fluoride concentration being maintained in the finished water. Go to STEP 9.
9. Wait thirty minutes and take another 25 ml sample from the FINISHED WATER sampling tap, then return to STEP 5.
10. Go to the FLUORIDE FEED INDICATOR dial on the control panel and turn the dial counterclockwise to reduce by 1 ppm the fluoride concentration being maintained in the finished water. Return to STEP 9.

11. In the chemical feed room, locate the FLUOSILICIC ACID DAY TANK which is a yellow plastic tank mounted on constantly weighing scales. Look at the scale and record on the inspection report the weight of the fluosilicic acid in the day tank. Go to STEP 12.

12. Subtract the weight recorded during this inspection from the weight recorded on the previous inspection and note the difference in weights on the inspection report. This difference in weights indicates the amount of fluosilicic acid used in the time interval between inspections. Go to STEP 13.

13. Look at the fill mark on the left side of the day tank to determine whether the fluosilicic acid is above, on, or below the mark:

    a. If the fluosilicic acid is on or below the fill mark, go to STEP 14.

    b. If the fluosilicic acid is above the fill mark, skip to STEP 19.

14. Locate the red handled valve in the fluosilicic acid day tank feed line (behind the scales) and open the valve by turning the handle counter clockwise. Go to STEP 15.

15. Locate the FLUORIDE DAY TANK FEED PUMP ON/OFF SWITCH (on the wall behind the scales) and turn the switch to ON to start the pump. Go to STEP 16.

16. Watch the tank fill to the FULL mark, then stop the feed pump by turning the switch to OFF. Go to STEP 17.

17. Close the valve in the fluosilicic acid day tank feed line by turning its handle clockwise. Go to STEP 18.

18. Determine the new fluosilicic acid weight from the scales, and note this new weight on the inspection report. Go to STEP 19.

19. Routine inspection of the fluoridation system completed.

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APPENDIX I

NARRATIVE PRESCRIPTIONS

RAW WATER SYSTEM AND INTAKE STRUCTURE
NARRATIVE PRESCRIPTION

1. *Routine inspection of the raw water pumps required . . .*

   --- On the inspection report, note which pump lights on the control panel are illuminated: . . . . . GO TO STEP 2

2. *Operational status of the raw water pumps determined from the illuminated lights on the control panel . . .*

   --- Look at the plant operation log to determine if pumps require daily shifting:

   Proper pump is not in operation--pumps do require shifting . . . . . STEP 3

   Proper pump is in operation . . . . . STEP 6

3. *Proper pump is not in operation--pumps do require shifting . . .*

   --- Look at the control panel and locate the START-STOP for the raw water pumps: . . . . . STEP 4

4. *START-STOP switches for the raw water pumps located . . .*

   --- Press STOP switch to stop previously operating pump: . . . . . STEP 5

5. *Pump has been stopped . . .*

   --- Press START switch to start the pump which should be operating that day: . . . . . STEP 6

6. *Proper pump is in operation . . .*

   --- Look at the raw water pump control panel to determine if the illuminated light corresponds to the pump which is in operation:

   Illuminated light and operating pump do not correspond . . . . . STEP 7

   Illuminated light and operating pump do correspond . . . . . STEP 9

7. *Illuminated light and operating pump do not correspond . . .*

--- Record the malfunction on the inspection report: . . STEP 8

8. *Malfunction recorded on the inspection report . . .*

--- Proceed to the intake structure and locate pump #1 for inspection: . . . . . STEP 10

9. *Illuminated light and operating pump do correspond . . .*

--- Proceed to the intake structure and locate pump #1: . . . . . STEP 10

10. *Pump located . . .*

--- Look at the coupling between the motor and the pump to determine the actual operational status of the pump. The pump is operating if the coupling is turning: . . . . . STEP 11

11. *Actual operational status of the pump determined . . .*

--- Look on the inspection report and determine if the actual operational status corresponds to the operational status indicated by the illuminated lights on the control panel:

Does not correspond . . . . . STEP 12

Does correspond . . . . . STEP 14

12. *Actual operational status of the pumps does not correspond to that indicated by the illuminated lights on the control panel . . .*

--- Note the discrepancy on the inspection report: . . . STEP 13

13. *Discrepancy noted . . .*

--- Locate the oil level indicator window on the upper left side of the pump motor: . . . . . STEP 15

14. *The actual operational status of the pump does correspond to that indicated by the illuminated light on the control panel . . .*

--- Locate the oil level indicator window on the upper left side of the pump motor: . . . . . STEP 15

15. *Oil level indicator window located . . .*

--- Look at the oil level and determine whether the oil is above or below the fill line:

The oil level is below the fill line . . . . . STEP 16

The oil level is above the fill line . . . . . STEP 19

16. *Oil level is below the fill line . . .*

--- Get proper weight oil from the supply room. Information about the weight of oil to use can be found in the manufacturer's manual for the pump. The manual is filed under RAW WATER PUMPS in the filing cabinet in the main control room: . . . . . STEP 17

17. *Oil obtained . . .*

--- Prepare to add oil to the reservoir by removing the plug from the fill hole located on top of the reservoir. Turn the plug counter-clockwise with a 1/4 inch Allen wrench: . . . . . STEP 18

18. *Plug removed . . .*

--- Add oil until its level is approximately 1 inch above the fill line and replace the plug: . . . . . STEP 19

19. *Oil level is above the fill line . . .*

--- Look at the inspection report and determine if both raw water pumps have been inspected:

Pumps #1 and 2 have been inspected . . . . . STEP 21

Pump #2 remains to be inspected . . . . . STEP 20

20. *Pump #2 remains to be inspected . . .*

--- Go to pump #2 and start its inspection: . . . . . STEP 10

21. *Pumps #1 and 2 have been inspected . . .*

--- Look at the intake opening gate cranks located behind the raw water pumps and determine which intake opening is being used. A gate is open when the threaded shaft reaches the top of the clear plastic housing above the crank wheel: . . . . STEP 22

22. *Intake opening which is in use has been determined . . .*

--- Look at the water level in the lake to determine if the intake opening in use is above the water level:

The intake opening is above the water level . . . STEP 23

The intake opening is below the water level . . . STEP 26

23. *The intake opening is above the water level . . .*

--- Look over the side of the intake structure to determine which intake opening should be in use. Any opening that is either fully or partially above the water surface should be closed. The intake opening to be used should be completely submerged: . . . . . STEP 24

24. *The intake opening which would be below the water level determined . . .*

--- Raise the gate over the opening by turning its crank which is located on top of the intake structure. Turning the crank wheel clockwise until the threaded shaft reaches the top of the clear housing will fully open the intake gate: . . . STEP 25

25. *New intake open and water is flowing into the intake structure . . .*

--- Close the previously used intake opening by turning its crank wheel counter-clockwise: . . . . . STEP 26

26. The intake opening is below the water level and the routine inspection of the raw water intake and pumping system is complete.

FLASH MIXER

NARRATIVE PRESCRIPTION

1. *Routine inspection of the flash mixer required . . .*

   --- Look at the control panel to determine the operational status of the flash mixer. The operational status is indicated by an illuminated START or STOP light: . . . . . GO TO STEP 2

2. *Operational status of the flash mixer determined from illuminated lights on the control panel . . .*

   --- Look at the mixer drive motor to determine whether the flash mixer is actually operating. The mixer is operating if the motor shaft is turning: . . . . STEP 3

3. *Actual operational status of the mixer determined . . .*

   --- Determine whether actual operational status of the mixer corresponds to the operational status indicated on the control panel:

   Does not correspond, green START light illuminated and the motor shaft not turning . . . STEP 4

   Does not correspond, red STOP light illuminated and the motor shaft is turning . . . STEP 5

   Does correspond, red STOP light illuminated and the motor shaft is not turning . . . . . . STEP 7

   Does correspond, green START light illuminated and the motor shaft is turning . . . STEP 12

4. *Green START light illuminated and motor shaft is not turning . . .*

   --- Notify maintenance about the malfunction:

   Maintenance notified . . . . . . STEP 19

5. *Red STOP light illuminated and the motor shaft is turning . . .*

   --- Note malfunction on inspection report: . . . . . STEP 6

6. *Malfunction noted . . .*

--- Look at the gear reducer housing on the mixer motor and locate the oil level indicator opening, which is fitted with a square head screw plug: . . . . . STEP 13

7. *Red STOP light illuminated and motor shaft not turning . . .*

--- Look at the control panel and locate the green button marked FLASH MIX START: . . . . . STEP 8

8. *FLASH MIX START button located . . .*

--- Press the START button: . . . . . STEP 9

9. *START button pressed . . .*

--- Look at the mixer motor to determine whether it is operating, as indicated by a turning shaft:

Mixer not operating . . . . . STEP 10

Mixer is operating . . . . . STEP 11

10. *Mixer not operating . . .*

--- Notify maintenance:

Maintenance notified . . . . . STEP 19

11. *Mixer is operating . . .*

--- Look at the gear reducer housing on the mixer motor and locate the oil level indicator opening, which is fitted with a square head screw plug: . . . STEP 13

12. *Green START light illuminated and the motor shaft is turning . . .*

--- Look at the gear reducer housing on the mixer motor and locate the oil level indicator opening, which is fitted with a square head screw plug: . . . STEP 13

13. *Oil level indicator opening located . . .*

--- Remove the plug by turning the screw counter clockwise with an adjustable wrench: . . . . . STEP 14

14. *Plug removed . . .*

--- Look at the opening to observe whether any oil trickles out . . .

Oil does not trickle from the opening . . . . . STEP 15

Oil does trickle from the opening . . . . . STEP 18

15. *Oil does not trickle from the oil level indicator opening . . .*

--- Get proper weight oil from the supply room. Information about the proper weight oil to use can be found in the manufacturer's manual for the motor, which is filed under FLASH MIXER in the filing cabinet in the main control room: . . . . . STEP 16

16. *Oil obtained . . .*

--- Add oil through the indicator opening until it trickles out when the oil can spout is removed: . . STEP 17

17. *Oil added . . .*

--- Replace the plug by inserting the screw into the opening and turning clockwise. Tighten the plug with the adjustable wrench until no oil escapes: . . STEP 19

18. *Oil trickles from the opening . . .*

--- Replace the plug by inserting the screw into the opening and turning clockwise. Tighten the plug with the adjustable wrench until no oil escapes: . . STEP 19

19. *Routine inspection of the flash mixer completed.*

FLOCCULATORS
NARRATIVE PRESCRIPTION

1. *Routine inspection of the flocculators required . . .*

   --- On the inspection report note which flocculator lights on the control panel are illuminated: . . . . GO TO STEP 2

2. *Operational status of the flocculators determined from the illuminated lights on the control panel . . .*

   --- Go to Flocculator #1 and determine if it is actually operating--It is considered to be operating if its paddle is turning: . . . . . STEP 3

3. *Actual operational status of the flocculator determined . . .*

   --- Determine whether the actual operational status of the flocculator corresponds to the operational status indicated on the control panel:

   Does not correspond, green START light illuminated and the paddle is not turning . . . . STEP 4

   Does not correspond, red STOP light illuminated and the paddle is turning . . . . . STEP 7

   Does correspond, red STOP light illuminated and the paddle is not turning . . . . . STEP 9

   Does correspond, green START light illuminated and the paddle is turning . . . . . STEP 14

4. *Green START light illuminated and the flocculator paddle is not turning . . .*

   --- Notify maintenance about the malfunction: . . . . . STEP 5

5. *Maintenance notified . . .*

   --- Look at the inspection report to determine if any flocculators remain to be inspected:

   Flocculator #2 remains to be inspected . . . . . STEP 6

   Flocculators #1 and 2 have been inspected . . . . STEP 24

6. *Flocculator #2 remains to be inspected . . .*

   --- Go to flocculator #2 and determine if it is actually in operation--It is in operation if its paddles are turning: . . . . . STEP 3

7. *Red light illuminated and the flocculator paddle is turning . . .*

   --- Note the malfunction on the inspection report: . . . STEP 8

8. *Malfunction noted . . .*

   --- Look on the deck beside the flocculator basin and locate the flocculator drive motor: . . . . . STEP 15

9. *Red STOP light illuminated and the flocculator paddle not turning . . .*

   --- Look at the control panel and locate the green button labeled FLOCCULATOR START: . . . . . STEP 10

10. *FLOCCULATOR START button located . . .*

    --- Press the FLOCCULATOR START button: . . . . . STEP 11

11. *FLOCCULATOR START button pressed . . .*

    --- Look at the paddles to determine whether the flocculator is operating, as indicated by a turning paddle:

        Flocculator is not operating . . . . . STEP 12

        Flocculator is operating . . . . . STEP 13

12. *Flocculator is not operating . . .*

    --- Notify maintenance: . . . . . STEP 5

13. *Flocculator is operating . . .*

    --- Look on the deck beside the flocculation basin and locate the flocculator drive motor: . . . . . STEP 15

14. *Green START light illuminated and the paddle is turning . . .*

--- Look on the deck beside the flocculation basin and locate the flocculator drive motor: . . . . . STEP 15

15. *Flocculator drive motor located . . .*

--- Look at the gear reducer housing on the drive motor and locate the oil level indicator opening which is fitted with a square head screw plug: . . . . . STEP 16

16. *Oil level indicator opening located . . .*

--- Remove the plug by turning the screw counter-clockwise with an adjustable wrench: . . . . . STEP 17

17. *Plug removed . . .*

--- Look at the oil level indicator opening to determine if any oil trickles out:

Oil does not trickle from the opening . . . . . STEP 19

Oil does trickle from the opening . . . . . STEP 21

18. *Oil does not trickle from the oil level indicator opening . . .*

--- Get proper weight oil from the supply room. Information about the proper weight oil to use can be found in the manufacturer's manual for the motor--This manual is filed under FLOCCULATORS in the filing cabinet in the main control room: . . STEP 19

19. *Oil obtained . . .*

--- Add oil through the indicator opening until it trickles out when the oil can spout is removed: . . . . . STEP 20

20. *Oil added . . .*

--- Replace the plug by inserting the screw into the opening and turning clockwise--Tighten the plug with the adjustable wrench until no oil escapes: . . STEP 22

21. *Oil does trickle from the opening . . .*

--- Replace the plug by inserting the square head screw into the opening and turning clockwise--Tighten the plug with a 6 inch adjustable wrench until no oil escapes: . . . . . STEP 22

22. *Plug replaced . . .*

--- Look at the inspection report to determine if any flocculators remain to be inspected:

Flocculator #2 has not been inspected . . . . . STEP 23

Flocculators #1 and 2 have been inspected . . . . STEP 24

23. *Flocculator #2 has not been inspected . . .*

--- Go to Flocculator #2 and determine if it is actually operating--It is considered to be operating if its paddle is turning: . . . . . STEP 3

24. *Routine inspection of the flocculators completed.*

RAPID SAND FILTERS
NARRATIVE PRESCRIPTION

1. *Filter headloss alarm buzzer sounds . . .*

   --- Silence buzzer by pressing the amber STOP ALARM button: . . . . . GO TO STEP 2

2. *Alarm buzzer silenced . . .*

   --- Determine which filter has excess headloss by looking for an illuminated red LOSS OF HEAD indicator light on the control panel: . . . . . STEP 3

3. *Filter with excess headloss indication determined--information mentally noted . . .*

   --- Determine if actual excess headloss condition exists in the filter by looking at the HEADLOSS INDICATOR CHART--excess headloss exists when the loss is 7 feet or greater: . . . . . STEP 4

4. *Actual headloss conditions in the filter determined . . .*

   --- Take action as required by the actual headloss conditions in the filter:

   Headloss not equal to or greater than 7 feet . . . . . STEP 5

   Headloss equal to or greater than 7 feet . . . . STEP 6

5. *Headloss in the filter not equal to or greater than 7 feet . . .*

   --- Notify maintennace of headloss alarm malfunction:

   Maintenance notified and no further action required.

6. *Headloss in the filter is equal to or greater than 7 feet . . .*

   --- Look at the control panel and locate the green FILTER WASH button for the filter that has excess headloss: . . . . . STEP 7

7. *FILTER WASH button located . . .*

--- Press the FILTER WASH button to start the backwash sequence: . . . . . STEP 8

8. *Backwash sequence started . . .*

--- Look at the control panel to locate the FILTER WASH MONITOR: . . . . . STEP 9

9. *FILTER WASH MONITOR located . . .*

--- Follow the backwash sequence by looking at the illuminated amber lights on the FILTER WASH MONITOR--The start of a step in the sequence will be indicated by the illumination of its amber light--The light will be extinguished upon completion of that step: . . . . . STEP 10

10. *Backwash sequence followed . . .*

--- Insure that the backwash sequence continues to completion:

Backwash sequence stops before completion . . . . STEP 11

Backwash sequence continued to completion . . . . STEP 18

11. *Backwash sequence stops before completion . . .*

--- Look beneath the FILTER WASH MONITOR and locate the amber RESTART button: . . . . . STEP 12

12. *RESTART button located . . .*

--- Press the RESTART button to start the next step in the backwash sequence: . . . . . STEP 13

13. *RESTART button pressed . . .*

--- Look at the FILTER WASH MONITOR to determine if the backwash sequence has restarted:

The backwash sequence did not restart . . . . . . STEP 14

The backwash sequence did restart . . . . . . STEP 17

14. *The backwash sequence did not restart . . .*

--- Immediately inform maintenance of the malfunction: . STEP 15

15. *Maintenance informed . . .*

--- Assist maintenance until relieved or repairs completed: . . . . . STEP 16

16. *Repairs completed . . .*

--- Press the RESTART button to start the next step in the backwash sequence: . . . . . STEP 13

17. *The backwash sequence restarts . . .*

--- Follow the backwash sequence by looking at the illuminated amber lights on the FILTER WASH MONITOR: . . . . . STEP 10

18. *Backwash sequence continues to completion.*

FINISHED WATER SERVICE SYSTEM
NARRATIVE PRESCRIPTION

1. *Routine inspection of the finished water service pumping automatic control system required . . .*

   --- Look at the ELEVATED STORAGE TANK WATER LEVEL indicator on the control panel and start the inspection when the tank is being filled--The tank is being filled when the WATER LEVEL INDICATOR shows the water level in the tank is rising: . . . . . GO TO STEP 2

2. *The elevated storage tank is being filled . . .*

   --- On the inspection report note if service pump #1 or #2 is operating: . . . . . STEP 3

3. *Information about the operating service pump noted . . .*

   --- When the water level in the elevated storage tank reaches 35 feet, look at the control panel and from the illuminated lights determine if the automatic controller shuts down the service pump that was operating--The pump has been shut down when its green ON light has been extinguished and its red OFF light has been illuminated:

   The pump is not automatically shut down . . . . . STEP 4

   The pump is automatically shut down . . . . . STEP 8

4. *The pump is not automatically shut down . . .*

   --- Look at the control panel and locate the red OFF button for the service pump that is operating: . . . STEP 5

5. *The OFF button has been located . . .*

   --- Manually shut down the pump by pressing the OFF button: . . . . . STEP 6

6. *The pump has been shut down . . .*

   --- Notify maintenance about the malfunction in the automatic shut-down portion of the service pump control system: . . . . . STEP 7

7. *Maintenance has been notified . . .*

--- Continue to watch the WATER LEVEL INDICATOR as the water level in the tank falls: . . . . . STEP 9

8. *The pump has been automatically shut down . . .*

--- Continue to watch the WATER LEVEL INDICATOR as the water level in the tank falls: . . . . . STEP 9

9. *Falling water level observed . . .*

--- When the water level reaches 26 feet, look at the control panel and from the illuminated lights determine if the automatic controller starts a service pump--The pump has started when its red OFF light is extinguished and its green ON light is illuminated:

A pump is not automatically started . . . . . STEP 10

A pump is automatically started . . . . . STEP 14

10. *A pump is not automatically started . . .*

--- Look at the control panel and locate the green ON button for the alternate pump to the one that was used to fill the tank in the initial stage of the inspection: . . . . . STEP 11

11. *The ON button for the alternate pump located . . .*

--- Manually start the pump by pressing the ON button: . . . . . STEP 12

12. *The alternate pump has been started . . .*

--- Notify maintenance about the malfunction in the automatic start-up portion of the service pump control system: . . . . . STEP 13

13. *Maintenance notified . . .*

--- Go to the pump house and locate service pump #1: . . STEP 21

14. *A pump is automatically started . . .*

--- Look at the inspection report and determine if the pump that started is the same one that was used to fill the tank in the initial stage of the inspection:

The same pump did start . . . . . STEP 15

The alternate pump has started . . . . . STEP 20

15. *The same pump did start . . .*

--- Notify maintenance about the malfunction in the system that automatically alternates service pump operation: . . . . . STEP 16

16. *Maintenance notified . . .*

--- Look at the control panel and locate the red OFF button for the pump that is operating: . . . . . STEP 17

17. *OFF button located . . .*

--- Stop the pump by pressing the OFF button: . . . . . STEP 18

18. *The pump has been stopped . . .*

--- Look at the control panel and locate the green ON button for the other pump: . . . . . STEP 19

19. *ON button located . . .*

--- Start the other pump by pressing the ON button: . . STEP 20

20. *The alternate pump has started . . .*

--- Go to the pump house and locate service pump #1: . . STEP 21

21. *The pump has been located . . .*

--- Locate the oil level indicator window on the upper left side of the pump motor: . . . . . STEP 22

22. *Oil level indicator window located . . .*

--- Look at the oil level and determine if it is above, on, or below the fill line:

The oil level is on or below the fill line . . . STEP 23

The oil level is above the fill line . . . . . . STEP 26

23. *The oil level is below the fill line . . .*

--- Get the proper weight oil from the supply room--Information about the weight of oil to use can be found in the manufacturer's manual for the pump. This manual is filed under SERVICE PUMPS in the filing cabinet in the main control room: . . . . . STEP 24

24. *Oil obtained . . .*

--- Prepare to add oil to the reservoir by removing its cap--The reservoir cap may be removed by turning it counter-clockwise: . . . . . STEP 25

25. *Oil reservoir cap has been removed . . .*

--- Add oil until its level is approximately 1 inch above the fill line and then replace the reservoir cap: . . . . . STEP 26

26. *The oil level is above the fill line . . .*

--- Look at the inspection report and determine if the oil level in both service pumps has been inspected:

Pump #2 remains to be inspected . . . . . . STEP 27

Pumps #1 and #2 have been inspected . . . . . . STEP 28

27. *Pump #2 remains to be inspected . . .*

--- Go to pump #2 and start the oil level inspection: . STEP 21

28. *Inspection of the fresh water service pumping system has been completed.*

CAUSTIC SODA FEED SYSTEM
NARRATIVE PRESCRIPTION

1. *Routine inspection of the caustic soda feed system required . . .*

   --- Look at the illuminated lights on the control panel and determine if the CAUSTIC SODA FEED PUMP is operating--The pump is operating if its green ON button is illuminated--It is not operating if its red OFF button is illuminated:

   The pump is not operating . . . . . GO TO STEP 2

   The pump is operating . . . . . STEP 3

2. *The CAUSTIC SODA FEED PUMP is not operating . . .*

   --- Start the pump by pressing its ON button: . . . . . STEP 3

3. *The CAUSTIC SODA FEED PUMP is operating . . .*

   --- Look at the CAUSTIC SODA FEED INDICATOR dial on the control panel, and on the inspection report, note the caustic soda concentration that is being maintained in the flash mixer--This concentration can be read directly in parts per million (ppm) from the scale opposite the dial: . . . . . STEP 4

4. *Information noted . . .*

   --- Go to the laboratory work bench and locate the water sampling tap labeled SETTLED WATER: . . . . . STEP 5

5. *SETTLED WATER sampling tap located . . .*

   --- Turn the faucet handle on the SETTLED WATER sampling tap and take a 25 ml sample of settled water: . . . STEP 6

6. *Settled water sample obtained . . .*

   --- Look on the laboratory work bench and locate the HACH Direct Reading Colorimeter water testing kit: . STEP 7

7. *HACH water testing kit located . . .*

   --- Determine the pH of the water by the procedure described in the testing kit instruction manual: . . STEP 8

8. *pH of the water determined . . .*

--- Note the pH of the water on the inspection report: . . . . . STEP 9

9. *Information noted . . .*

--- Determine if the pH of the water is within the optimum pH range of 7.7 to 7.9:

The pH of the water is less than 7.7 . . . . . STEP 10

The pH of the water is greater than 7.9 . . . . . STEP 12

The pH of the water is within the optimum range of 7.7 to 7.9 . . . . . STEP 14

10. *The pH of the water is less than 7.7 . . .*

--- Go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and increase the caustic soda concentration in the flash mixer by 1 ppm--The concentration is increased by turning the dial clockwise: . . . . . STEP 11

11. *Caustic soda concentration in the flash mixer increased by 1 ppm . . .*

--- Wait two hours and take another 25 ml sample from the settled water sampling tap: . . . . . STEP 6

12. *The pH of the water is greater than 7.9 . . .*

--- Go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and reduce the caustic soda concentration in the flash mixer by 1 ppm--The concentration is reduced by turning the dial counter-clockwise: . . . . . STEP 13

13. *Caustic soda concentration in the flash mixer reduced by 1 ppm . . .*

--- Wait two hours and take another 25 ml sample from the settled water tap: . . . . . STEP 6

14. *The pH of the water is within the optimum range of 7.7 and 7.9 . . .* STEP 15

15. *Inspection of the caustic soda feed system completed.*

ALUM FEED SYSTEM
NARRATIVE PRESCRIPTION

1. *Routine inspection of the alum feed system required . . .*

   --- Look at the illuminated lights on the control panel and determine if the ALUM FEED PUMP is operating--The pump is operating if its green ON button is illuminated--It is not operating if its red OFF button is illuminated:

   The pump is not operating . . . . . GO TO STEP 2

   The pump is operating . . . . . STEP 3

2. *The ALUM FEED PUMP is not operating . . .*

   --- Start the pump by pressing its ON button: . . . . . STEP 3

3. *The ALUM FEED PUMP is operating . . .*

   --- Go to the ALUM FEED INDICATOR dial on the control panel, and on the inspection report, note the alum concentration that is being maintained in the flash mixer--This concentration can be read in parts per million (ppm) on the scale opposite the dial: . . . STEP 4

4. *Information noted . . .*

   --- Go to the flocculator end of the sedimentation basin, and by looking into the water, determine if any white, pea-sized floc particles are suspended in the water:

   Floc particles are not suspended in the water . . STEP 5

   Floc particles are suspended in the water . . . . STEP 11

5. *Floc particles are not suspended in the water . . .*

   --- Go to the chemical feed room and locate the fiber glass tank labeled ALUM DAY TANK: . . . . . STEP 6

6. *ALUM DAY TANK located . . .*

--- Look at the sight glass on the right side of the day tank and determine if the tank contains any alum:

Day tank does not contain any alum . . . . . STEP 7

Day tank does contain alum . . . . . STEP 9

7. *Day tank does not contain any alum . . .*

--- Notify maintenance about a malfunction in the day tank automatic fill system: . . . . . STEP 8

8. *Maintenance notified* . . . . . STEP 11

9. *Day tank does contain alum . . .*

--- Notify plant supervisor that alum dosage being used does not produce floc and that jar tests should be initiated to determine correct dosage: . . . . . STEP 10

10. *Plant supervisor notified* . . . . . STEP 11

11. *Routine inspection of the alum feed system completed.*

CHLORINATION SYSTEM
NARRATIVE PRESCRIPTION

1. *Routine inspection of the chlorine feed system required . . .*

   --- Go to the laboratory work bench and locate the water sampling tap labeled SETTLED WATER: . . . . . GO TO STEP 2

2. *SETTLED WATER sampling tap located . . .*

   --- Turn the faucet handle on the sampling tap and take a 25 ml sample of the settled water: . . . . . STEP 3

3. *Sample obtained . . .*

   --- Look on the laboratory work bench and locate the HACH Direct Reading Colorimeter water testing kit: . . . . . STEP 4

4. *HACH water testing kit located . . .*

   --- Determine the chlorine concentration in the water by the procedure described in the testing kit instruction manual: . . . . . STEP 5

5. *Chlorine concentration in the sample determined . . .*

   --- Note the chlorine concentration on the inspection report: . . . . . STEP 6

6. *Information noted . . .*

   --- Determine if the chlorine concentration is within the required 0.25 to 0.45 ppm range:

   The chlorine concentration is less than 0.25 ppm . . . . . STEP 7

   The chlorine concentration is greater than 0.45 ppm . . . . . STEP 25

   The chlorine concentration is within the 0.25 to 0.45 ppm range . . . . . STEP 29

7. *The chlorine concentration is less than 0.25 ppm . . .*

--- Go to the chlorinator room and locate the chlorinator labeled PRECHLORINATOR: . . . . . STEP 8

8. *PRECHLORINATOR located . . .*

--- Look at the rotameter float indicator and determine if the maximum allowable precnlorination dose is being used--The maximum prechlorination dose is marked on the rotameter scale and is labeled MAX DOSE:

Maximum allowable prechlorination dose is not being used . . . . . STEP 9

Maximum allowable prechlorination dose is being used . . . . . STEP 12

9. *Maximum allowable prechlorination dose is not being used . . .*

--- Look on the front of the prechlorinator and locate the DOSAGE RATE CONTROLLER knob: . . . . . STEP 10

10. *DOSAGE RATE CONTROLLER knob located . . .*

--- Increase the rate of prechlorination by turning tne dosage rate controller knob clockwise until the rotameter float has risen one scale division: . . . . . STEP 11

11. *Rate of prechlorination increased . . .*

--- Wait two hours and take another 25 ml sample from the SETTLED WATER sampling tap: . . . . . STEP 3

12. *Maximum allowable prechlorination dose is being used . . .*

--- Look at the control panel in the main control room and locate the POST-CHLORINATOR ON button: . . STEP 13

13. *POST-CHLORINATOR ON button located . . .*

--- Start the post-chlorinator by pressing its ON button: . . . . . STEP 14

14. *Post-chlorinator started . . .*

--- Go to the chlorinator room and locate the POST-CHLORINATOR--The post-chlorinator is located to the right of the pre-chlorinator: . . . . . STEP 15

15. *Post-chlorinator located . . .*

--- Look behind the post-chlorinator and locate the black-handled valve in the chlorine feed line: . . . STEP 16

16. *Valve located . . .*

--- Open the valve by turning the level handle counter-clockwise until it is parallel to the direction in which the feed line runs: . . . . . STEP 17

17. *Valve opened . . .*

--- Look at the front of the post-chlorinator and locate the DOSAGE RATE CONTROLLER knob: . . . . . STEP 18

18. *DOSAGE RATE CONTROLLER knob located . . .*

--- Turn the knob in the direction required to adjust the rotameter float to the first division on its scale: . . . . . STEP 19

19. *Dosage rate adjusted . . .*

--- Wait 30 minutes and take a 25 ml sample from the FINISHED WATER sampling tap: . . . . . STEP 20

20. *Sample obtained . . .*

--- Determine the chlorine concentration in the water by the procedure described in the HACH water testing kit instruction manual: . . . . . STEP 21

21. *Chlorine concentration determined . . .*

--- Note the concentration on the inspection report: . . STEP 22

22. *Information noted . . .*

--- Determine if the chlorine concentration in the finished water is within the required 0.25 to 0.45 ppm range:

The chlorine concentration is still below 0.25 ppm . . . . . STEP 23

The chlorine concentration is within the 0.25 to 0.45 ppm range . . . . . STEP 29

23. *The chlorine concentration is still below 0.25 ppm . . .*

--- Return to chlorination room and increase the chlorine dosage rate by turning the DOSAGE RATE CONTROLLER knob clockwise until the rotameter float rises one scale division: . . . . . STEP 24

24. *Chlorine dosage rate increased . . .*

--- Wait 30 minutes and take another sample from the FINISHED WATER sampling tap: . . . . . STEP 20

25. *The chlorine concentration is greater than 0.45 ppm . . .*

--- Go to the chlorinator room and locate the chlorinator labeled PRE-CHLORINATOR: . . . . . STEP 26

26. *PRE-CHLORINATOR located . . .*

--- Look at the front of the chlorinator and locate the DOSAGE RATE CONTROLLER knob: . . . . . STEP 27

27. *DOSAGE RATE CONTROLLER located . . .*

--- Turn the knob counter-clockwise until the dosage rate has been reduced by one division on the rotameter scale: . . . . . STEP 28

28. *Chlorine dosage rate decreased . . .*

--- Wait two hours and take another 25 ml sample from the SETTLED WATER sampling tap: . . . . . STEP 3

29. *The chlorine concentration is within the 0.25 to 0.45 ppm range . . .*

--- Go to the chlorine cylinder storage room and locate the constantly weighing scales: . . . . . STEP 30

30. *Constantly weighing scales located . . .*

--- Look at the scales and note the cylinder weight on the inspection report: . . . . . STEP 31

31. *Weight noted . . .*

--- Subtract this weight from the weight noted during the previous inspection--The difference in weights is the weight of chlorine that has been used in the time period between inspections: . . . . . STEP 32

32. *Difference in weight determined . . .*

--- Note this figure on the inspection report: . . . . . STEP 33

33. *Information noted* . . . . . STEP 34

34. *Routine inspection of the chlorine feed system required.*

FLUORIDATION SYSTEM
NARRATIVE PRESCRIPTION

1. *Routine inspection of the fluoridation system required . . .*

   --- Look at the illuminated lights on the control panel and determine if the FLUORIDE FEED PUMP is operating--The pump is operating if its green ON button is illuminated--It is not operating if its red OFF button is illuminated:

   The pump is not operating . . . . . GO TO STEP 2

   The pump is operating . . . . . STEP 3

2. *The FLUORIDE FEED PUMP is not operating . . .*

   --- Start the pump by pressing its ON button: . . . . . STEP 3

3. *The FLUORIDE FEED PUMP is operating . . .*

   --- Look at the FLUORIDE FEED INDICATOR dial on the control panel, and on the inspection report, note the fluoride concentration being maintained in the flash mixer--This concentration can be read in parts per million (ppm) on the scale opposite the dial: . . . . . STEP 4

4. *Information noted . . .*

   --- Go to the laboratory work bench and locate the water sampling tap labeled FINISHED WATER: . . . . . STEP 5

5. *FINISHED WATER sampling tap located . . .*

   --- Turn the faucet handle and take a 25 ml sample of finished water: . . . . . STEP 6

6. *Finished water sample obtained . . .*

   --- Look on the laboratory work bench and locate the HACH Direct Reading Colorimeter water testing kit: . STEP 7

7. *HACH water testing kit located . . .*

   --- Determine the fluoride concentration in the finished water by the procedure described in the testing kit instructions: . . . . . STEP 8

8. *Fluoride concentration in the finished water determined . . .*

--- Note the fluoride concentration of the water on the inspection report: . . . . . STEP 9

9. *Information noted . . .*

--- Determine if the fluoride concentration in the finished water is within the prescribed 0.9 to 1.0 ppm range:

The fluoride concentration in the finished water is less than 0.9 ppm . . . . . STEP 10

The fluoride concentration in the finished water is greater than 1.0 ppm . . . . . STEP 12

The fluoride concentration in the finished water is within the prescribed 0.9 to 1.0 ppm . . . . . STEP 14

10. *The fluoride concentration in the finished water is less than 0.9 ppm . . .*

--- Go the the FLUORIDE FEED INDICATOR dial on the control panel and increase by 1 ppm the fluoride concentration being maintained in the finished water--Turn the dial clockwise to increase the fluoride feed rate to the finished water: . . . . . STEP 11

11. *Fluoride concentration in the finished water increased . . .*

--- Wait thirty minutes and take another 25 ml sample from the FINISHED WATER sampling tap: . . . . . STEP 6

12. *The fluoride concentration in the finished water is greater than 1.0 ppm . . .*

--- Go to the FLUORIDE FEED INDICATOR dial on the control panel and decrease by 1 ppm the concentration being maintained in the finished water--Turn the dial counter-clockwise to reduce the fluoride feed rate to the finished water: . . . . . STEP 13

13. *Fluoride concentration in the finished water reduced . . .*

--- Wait thirty minutes and take another 25 ml sample from the FINISHED WATER sampling tap: . . . . . STEP 6

14. *The fluoride concentration in the finished water is within the prescribed 0.9 to 2.0 ppm range . . .*

--- Go to the chemical feed room and locate the fluosilicic acid day tank--It is the yellow plastic tank which is mounted on constantly weighing scales: . . . . . STEP 15

15. *Fluosilicic acid day tank located . . .*

--- Look at the scale and record the weight of the fluosilicic acid in the day tank: . . . . . STEP 16

16. *Weight recorded . . .*

--- Subtract the weight recorded during this inspection from the weight recorded on the previous inspection and note the difference in weights on the inspection report--This difference in weights indicates the amount of fluosilicic acid used in the time interval between inspections: . . . . . STEP 17

17. *Weight difference noted . . .*

--- Look at the fill mark on the left side of the day tank and determine if the fluosilicic acid is above or below the mark:

The fluosilicic acid level is below the fill mark . . . . . STEP 18

The fluosilicic acid level is above the fill mark . . . . . STEP 27

18. *The fluosilicic acid level is below the fill mark . . .*

--- Look behind the scales and locate the red-handled valve in the fluosilicic acid day tank feed line: .. STEP 19

19. *Valve located . . .*

--- Open the valve by turning the handle counter-clockwise: . . . . . STEP 20

20. *Valve open . . .*

--- Look on the wall behind the scales and locate the FLUORIDE DAY TANK FEED PUMP ON/OFF switch: . . . . . STEP 21

21. *ON/OFF switch located . . .*

--- Start the pump by pressing the ON button: . . . . . STEP 22

22. *Pump started . . .*

--- Watch the day tank fill until it reaches the FULL mark: . . . . . STEP 23

23. *FULL mark reached . . .*

--- Stop the feed pump by pressing its OFF button: . . . STEP 24

24. *Pump stopped . . .*

--- Close the valve in the fluosilicic day tank feed line by turning its handle clockwise: . . . . . STEP 25

25. *Valve closed . . .*

--- Look at the scales, and on the inspection report, note the new fluosilicic acid weight: . . . . . STEP 26

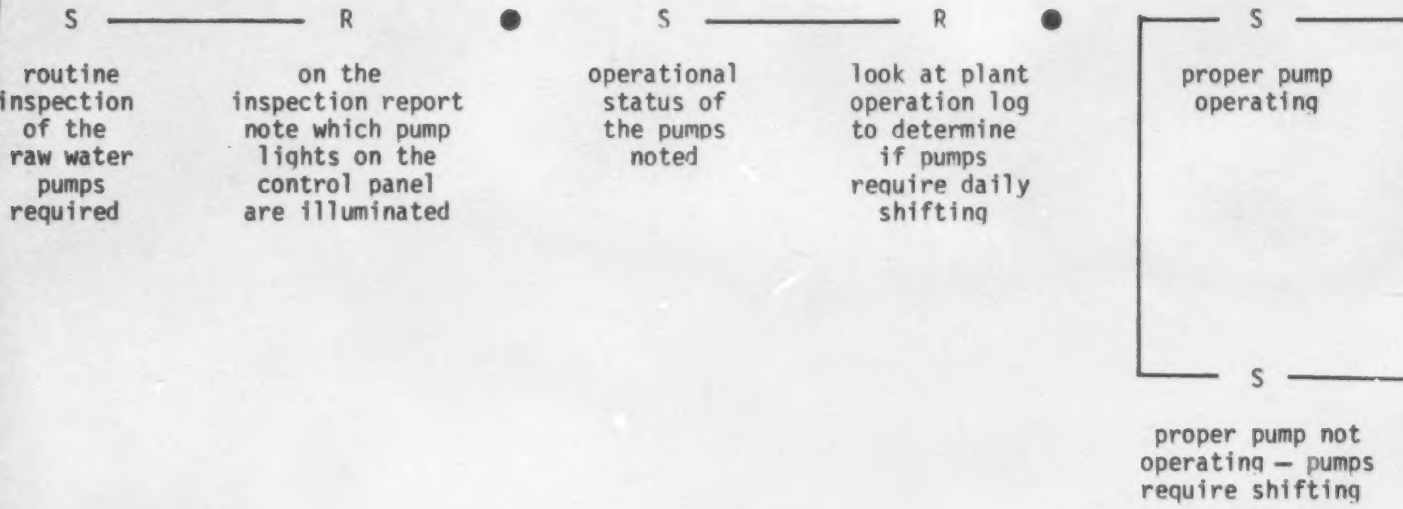
26. *New weight noted* . . . . . STEP 27

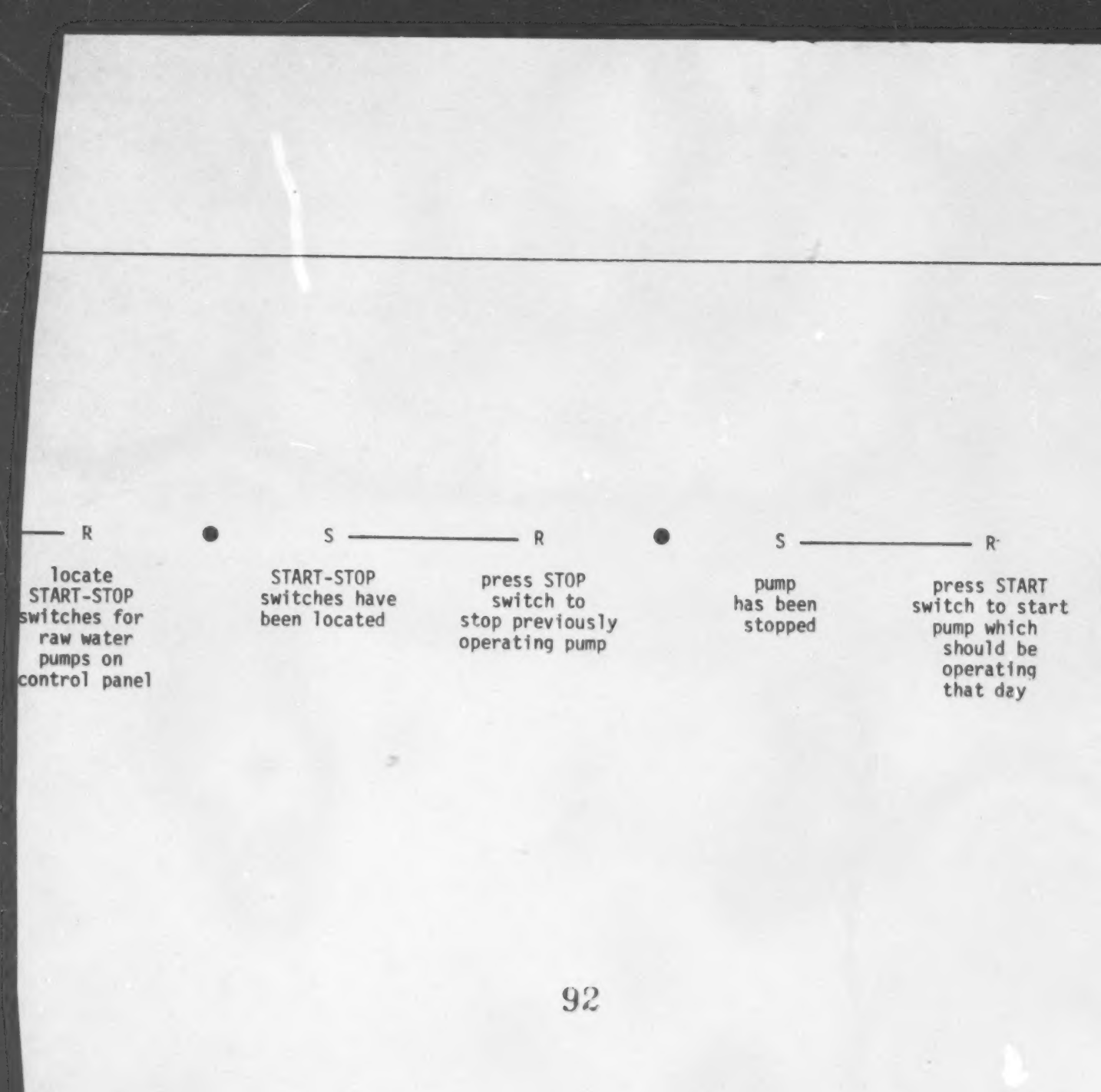
27. *Routine inspection of the fluoridation system complete.*

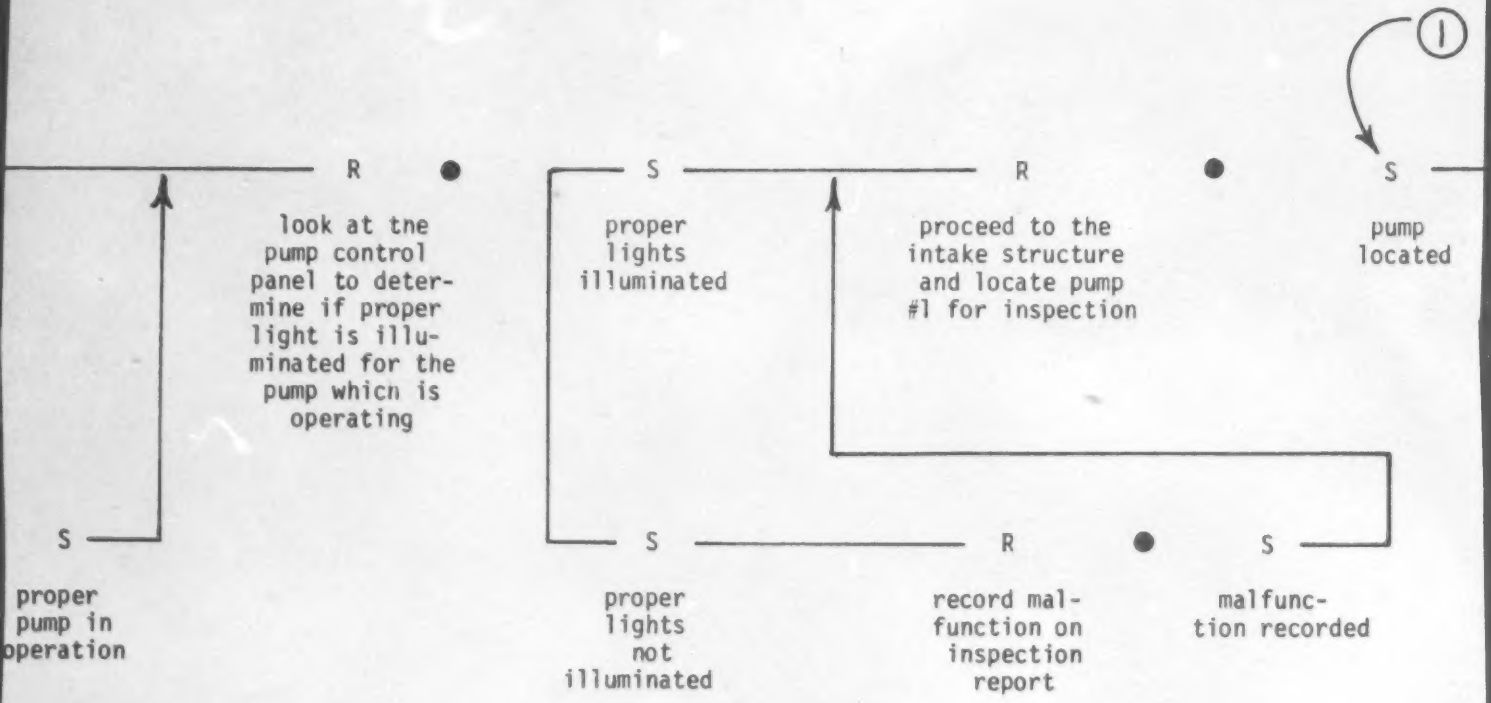
APPENDIX II

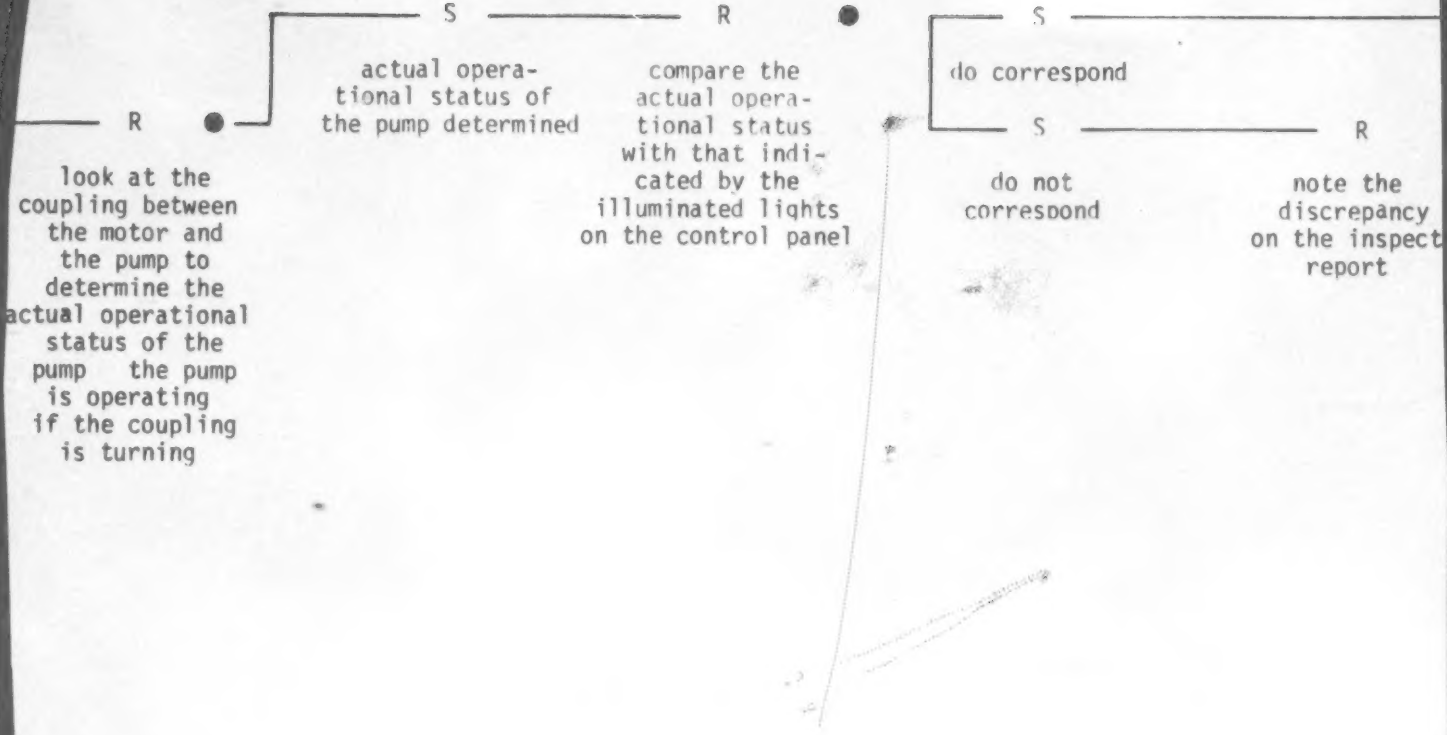
FLOW PRESCRIPTIONS

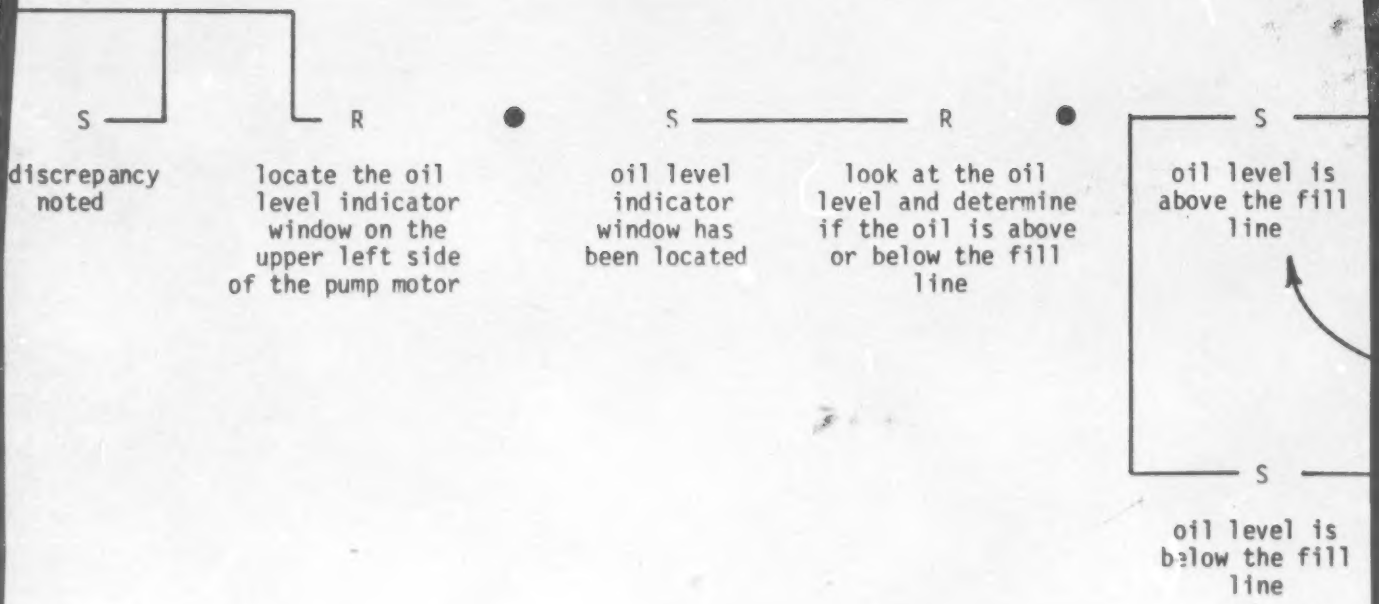
RAW WATER SYSTEM AND INTAKE STRUCTURE FLOW PRESCRIPTION

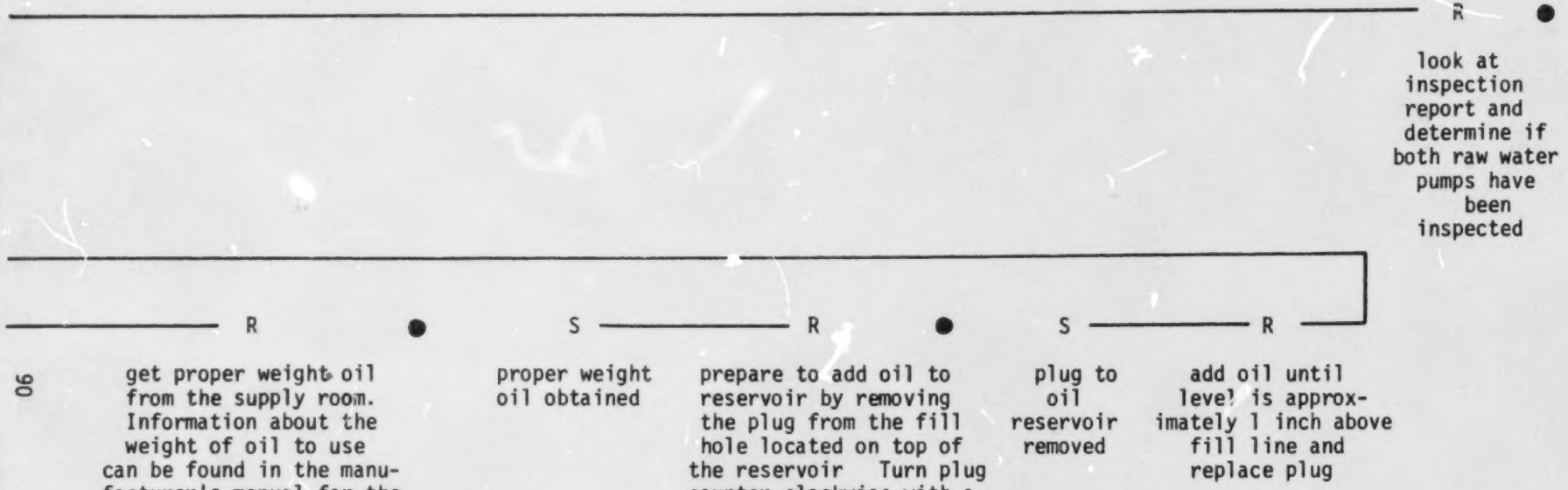

S
R
routine inspection of the raw water pumps required
on the inspection report note which pump lights on the control panel are illuminated
S
R
operational status of the pumps noted
look at plant operation log to determine if pumps require daily shifting
S
proper pump operating
S
proper pump not operating – pumps require shifting


R
locate START-STOP switches for raw water pumps on control panel
S
R
START-STOP switches have been located
press STOP switch to stop previously operating pump
S
R
pump has been stopped
press START switch to start pump which should be operating that day

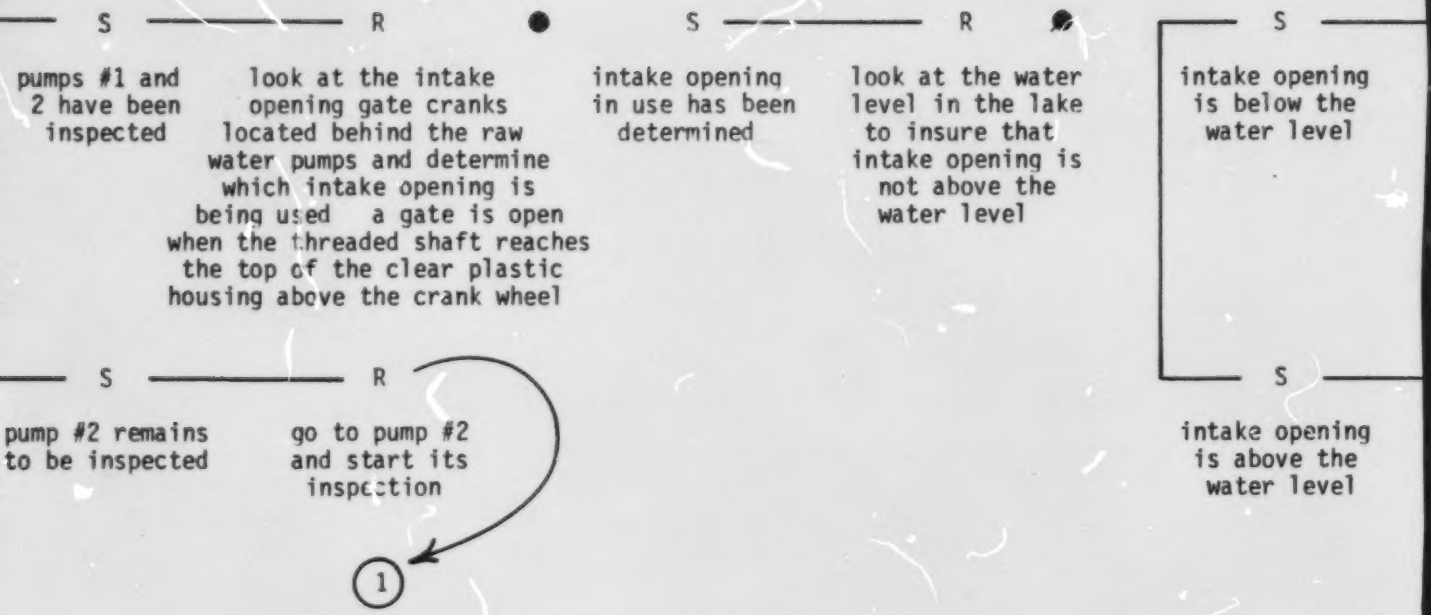

1
R
look at the pump control panel to determine if proper light is illuminated for the pump which is operating
S
proper pump in operation
S
proper lights illuminated
R
proceed to the intake structure and locate pump #1 for inspection
S
pump located
S
proper lights not illuminated
R
record malfunction on inspection report
S
malfunction recorded


R
look at the coupling between the motor and the pump to determine the actual operational status of the pump the pump is operating if the coupling is turning
S
actual operational status of the pump determined
R
compare the actual operational status with that indicated by the illuminated lights on the control panel
S
do correspond
S
do not correspond
R
note the discrepancy on the inspect report


S
R
discrepancy noted
locate the oil level indicator window on the upper left side of the pump motor
S
R
oil level indicator window has been located
look at the oil level and determine if the oil is above or below the fill line
S
oil level is above the fill line
S
oil level is below the fill line


R
look at inspection report and determine if both raw water pumps have been inspected
R
get proper weight oil from the supply room. Information about the weight of oil to use can be found in the manufacturer's manual for the pump This manual is filed under RAW WATER INTAKE PUMP in the filing cabinet in the main control room
S
proper weight oil obtained
R
prepare to add oil to reservoir by removing the plug from the fill hole located on top of the reservoir Turn plug counter clockwise with a 1/4 inch allen wrench
S
plug to oil reservoir removed
R
add oil until level is approximately 1 inch above fill line and replace plug

90


S
pumps #1 and 2 have been inspected
R
look at the intake opening gate cranks located behind the raw water pumps and determine which intake opening is being used a gate is open when the threaded shaft reaches the top of the clear plastic housing above the crank wheel
S
intake opening in use has been determined
R
look at the water level in the lake to insure that intake opening is not above the water level
S
intake opening is below the water level
S
pump #2 remains to be inspected
R
go to pump #2 and start its inspection
S
intake opening is above the water level
1

R

look over the side of the intake tructure to determine which intake opening hat is either fully or rtially above the water rface should be closed. e intake opening to be ed should be completely submerged

S — R

intake opening which would be below the water level determined

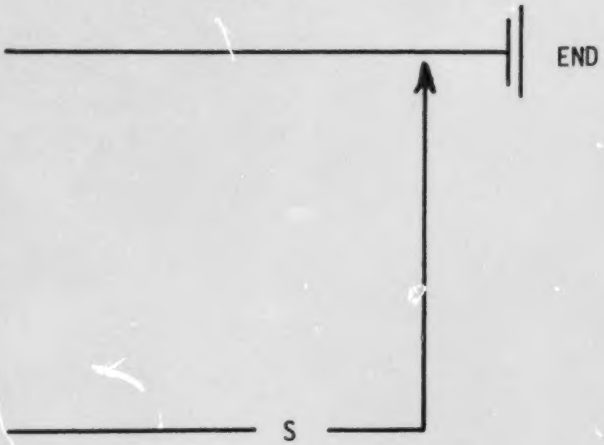
raise gate over the opening by turning its crank which is located on top of the intake structure turn the crank handle clockwise to raise the gate. the gate is fully open when the threaded shaft reaches the top of the clear housing on top of the crank

S — R

new intake level is open and raw water is flowing into the intake structure

R

close previously used intake opening by turning its crank in counter clockwise direction



93

lake level
is above the
intake opening

FLASH MIXER
FLOW PRESCRIPTION

S — R

routine
nspection
of the
lash mixer
required

look at the
control panel
to determine
the operating
status of the
flash mixer
The operating
status is
indicated by
an illuminated
START or STOP
light

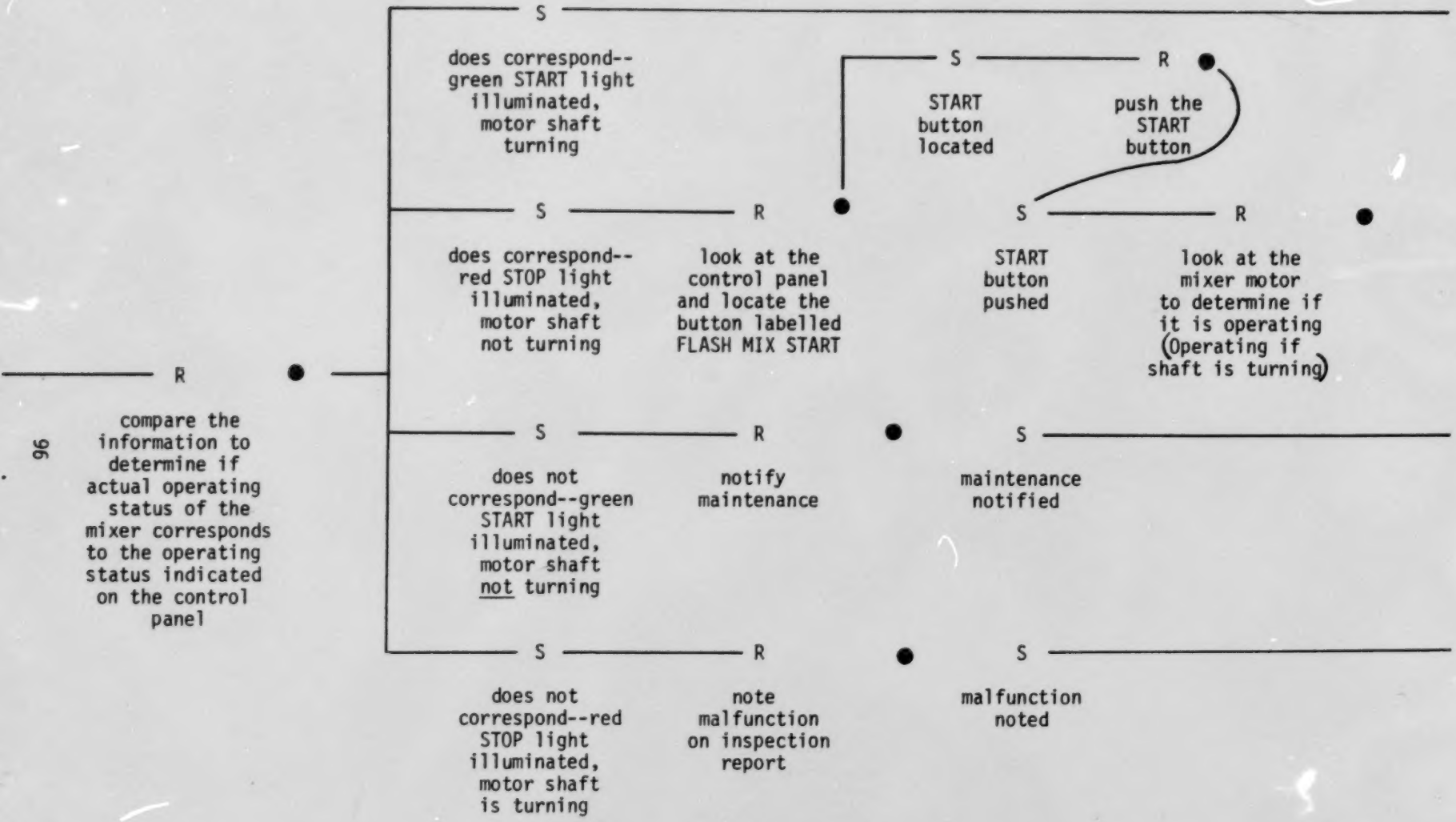
S — R

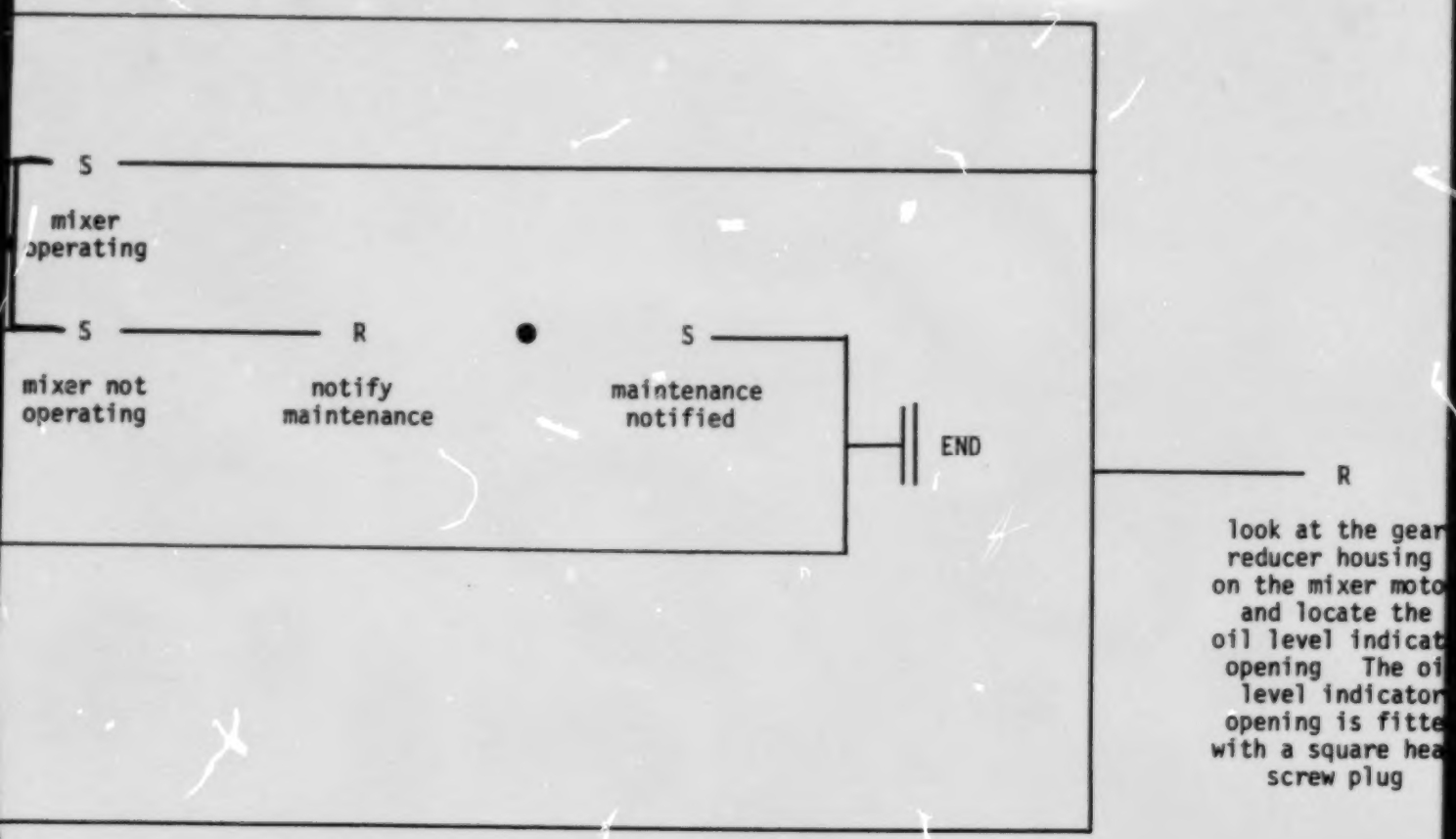
operating
status
noted

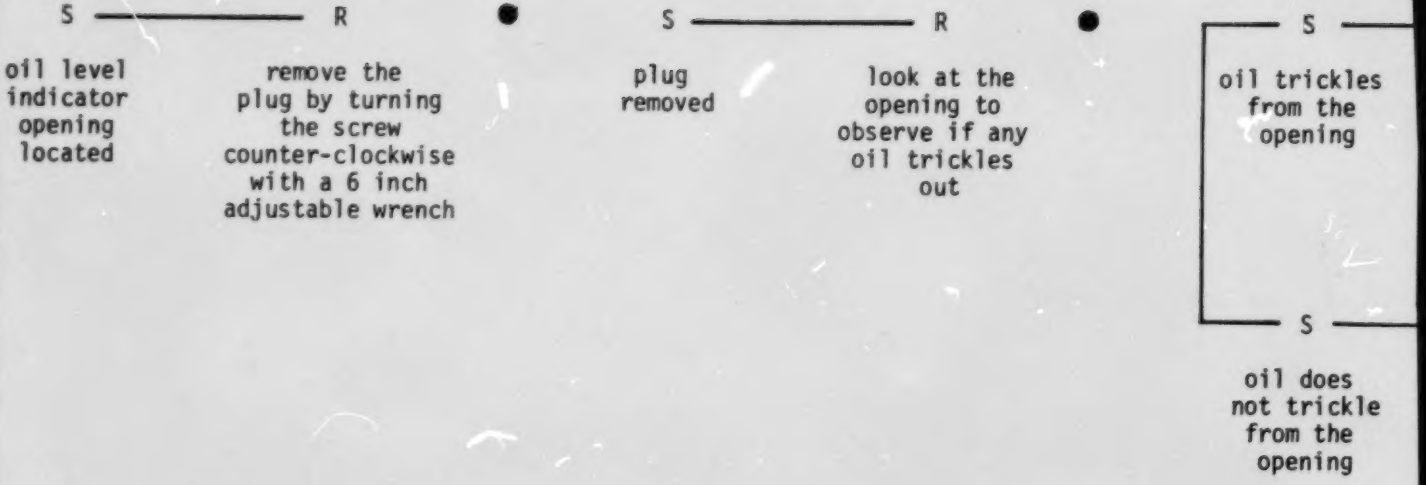
look at the
mixer drive motor
to determine if
the flash mixer
is actually
operating The
mixer is considered
to be operating
if the motor shaft
is turning

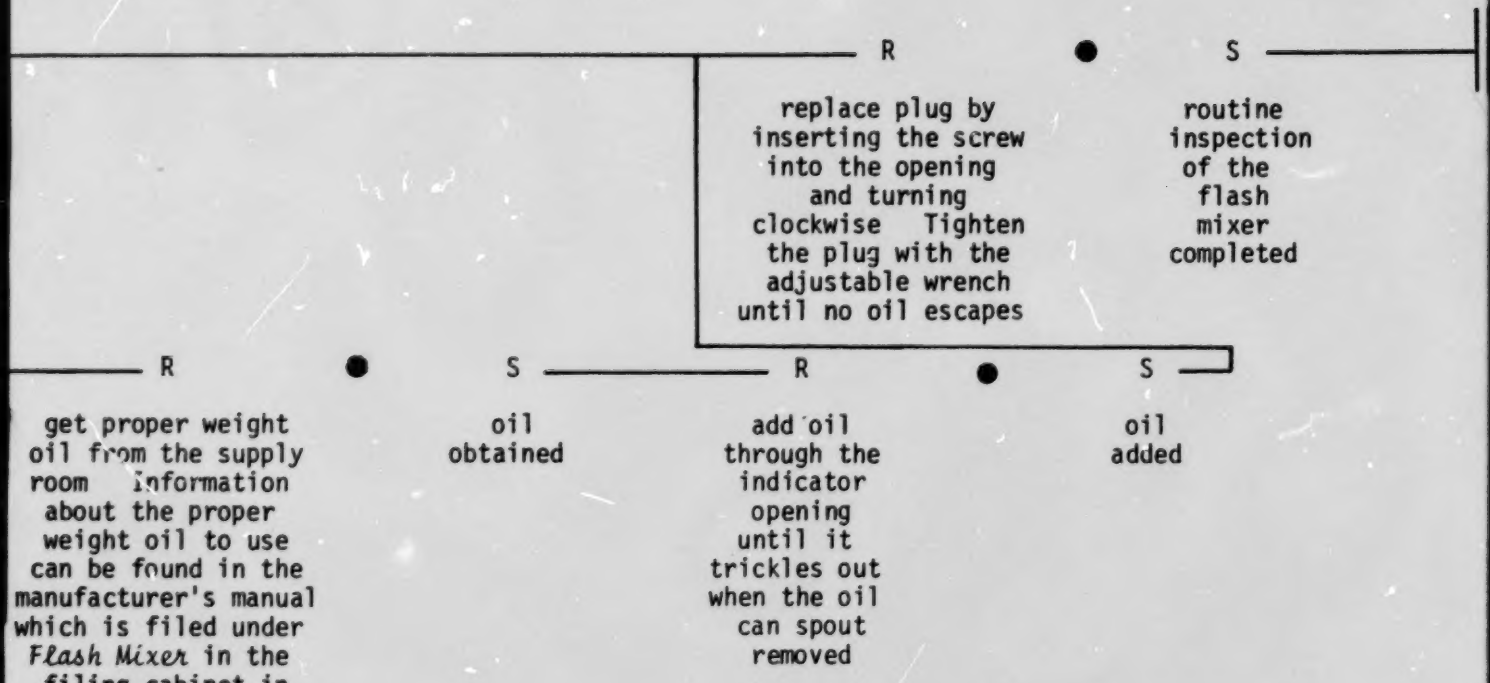
S —

actual
operating
status
of the
mixer motor
noted

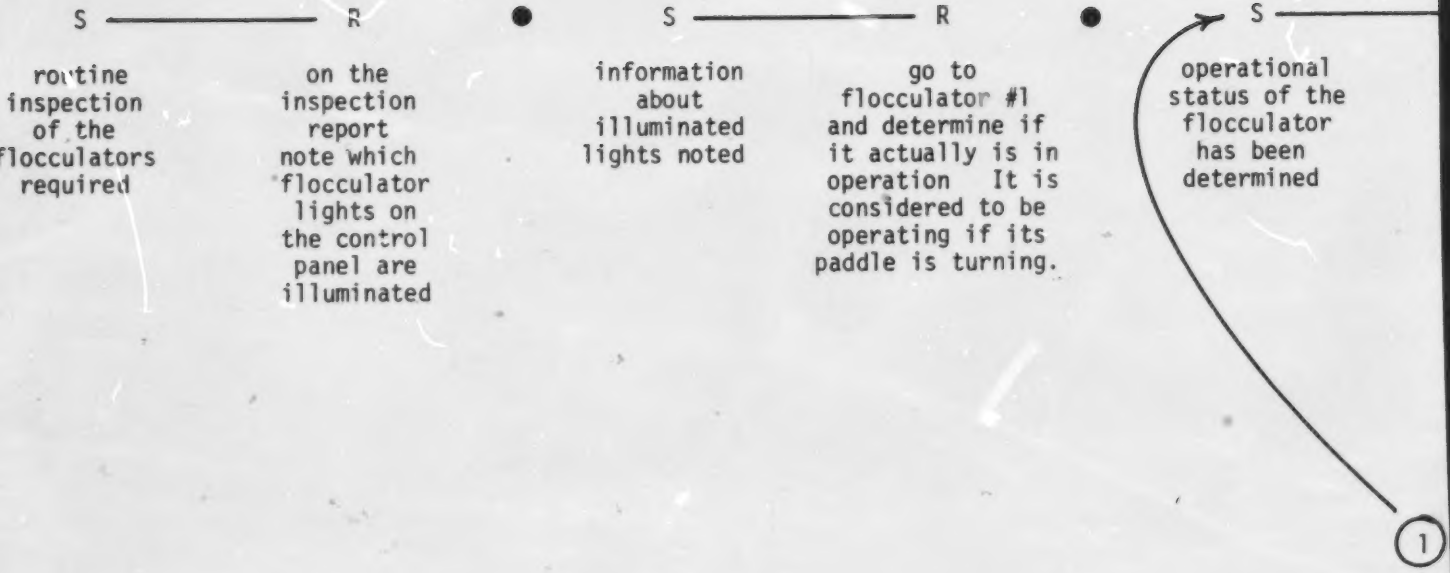

R
compare the information to determine if actual operating status of the mixer corresponds to the operating status indicated on the control panel
96
S
does correspond--green START light illuminated, motor shaft turning
S
R
START button located
push the START button
S
R
does correspond--red STOP light illuminated, motor shaft not turning
look at the control panel and locate the button labelled FLASH MIX START
S
R
START button pushed
look at the mixer motor to determine if it is operating (Operating if shaft is turning)
S
R
does not correspond--green START light illuminated, motor shaft not turning
notify maintenance
S
maintenance notified
S
R
does not correspond--red STOP light illuminated, motor shaft is turning
note malfunction on inspection report
S
malfunction noted

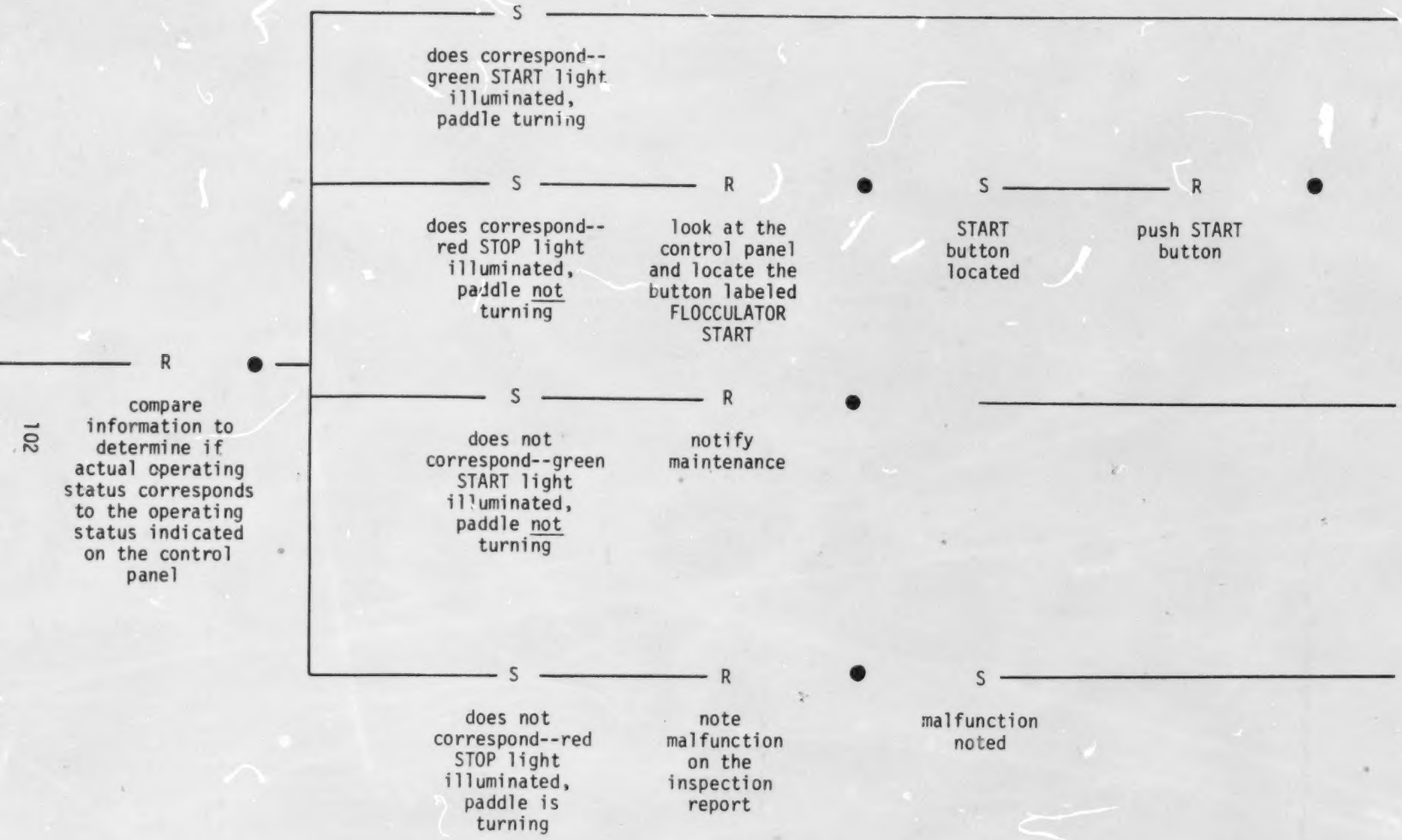

S
mixer
operating
S
mixer not
operating
R
notify
maintenance
S
maintenance
notified
END
R
look at the gear
reducer housing
on the mixer moto
and locate the
oil level indicat
opening The oi
level indicator
opening is fitte
with a square hea
screw plug


S
R
oil level indicator opening located
remove the plug by turning the screw counter-clockwise with a 6 inch adjustable wrench
S
R
plug removed
look at the opening to observe if any oil trickles out
S
oil trickles from the opening
S
oil does not trickle from the opening

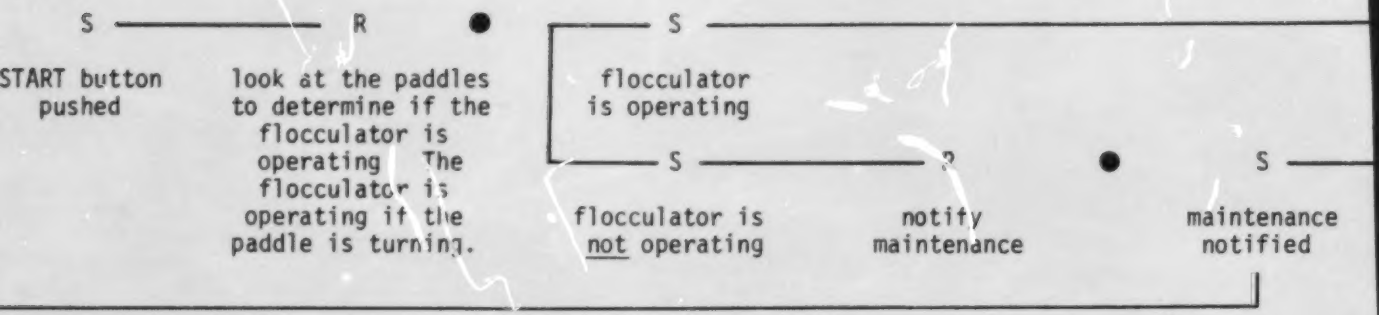

R
S
replace plug by inserting the screw into the opening and turning clockwise Tighten the plug with the adjustable wrench until no oil escapes
routine inspection of the flash mixer completed
R
S
R
S
get proper weight oil from the supply room Information about the proper weight oil to use can be found in the manufacturer's manual which is filed under Flash Mixer in the filing cabinet in main control room
oil obtained
add oil through the indicator opening until it trickles out when the oil can spout removed
oil added

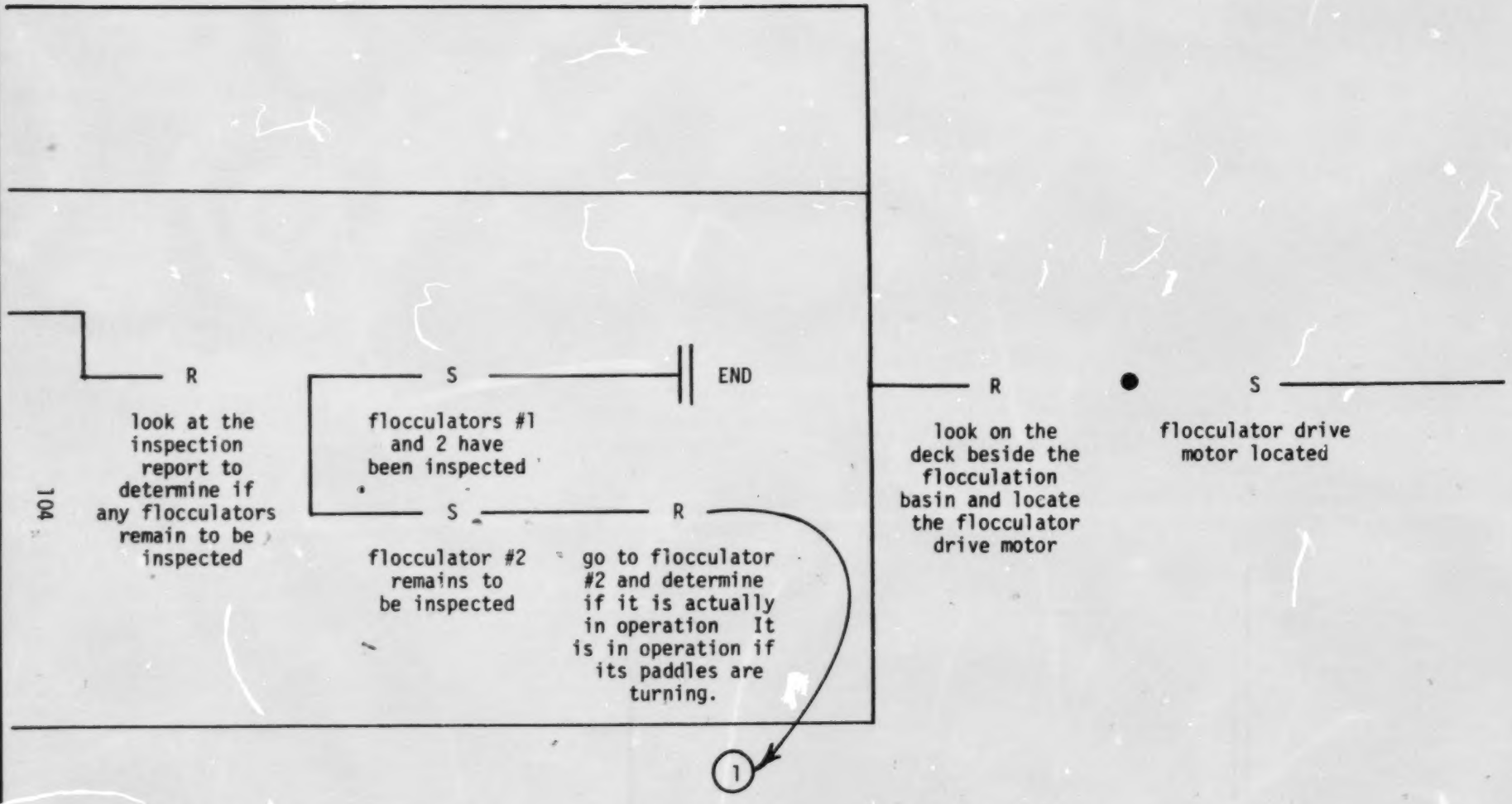
FLOCCULATORS
FLOW PRESCRIPTION


S
routine inspection of the flocculators required
R
on the inspection report note which flocculator lights on the control panel are illuminated
S
information about illuminated lights noted
R
go to flocculator #1 and determine if it actually is in operation It is considered to be operating if its paddle is turning.
S
operational status of the flocculator has been determined
1


R
compare information to determine if actual operating status corresponds to the operating status indicated on the control panel
S
does correspond--green START light illuminated, paddle turning
S
does correspond--red STOP light illuminated, paddle not turning
R
look at the control panel and locate the button labeled FLOCCULATOR START
S
START button located
R
push START button
S
does not correspond--green START light illuminated, paddle not turning
R
notify maintenance
S
does not correspond--red STOP light illuminated, paddle is turning
R
note malfunction on the inspection report
S
malfunction noted

102


S
R
S
START button pushed
look at the paddles to determine if the flocculator is operating The flocculator is operating if the paddle is turning.
flocculator is operating
S
?
S
flocculator is not operating
notify maintenance
maintenance notified


R
look at the inspection report to determine if any flocculators remain to be inspected
S
flocculators #1 and 2 have been inspected
END
S
flocculator #2 remains to be inspected
R
go to flocculator #2 and determine if it is actually in operation It is in operation if its paddles are turning.
1
R
look on the deck beside the flocculation basin and locate the flocculator drive motor
S
flocculator drive motor located

104

105

R

look at the gear reducer housing on the drive motor and locate the oil level indicator opening The oil level indicator opening is fitted with a square head screw plug.

115

S — R

oil level indicator opening located

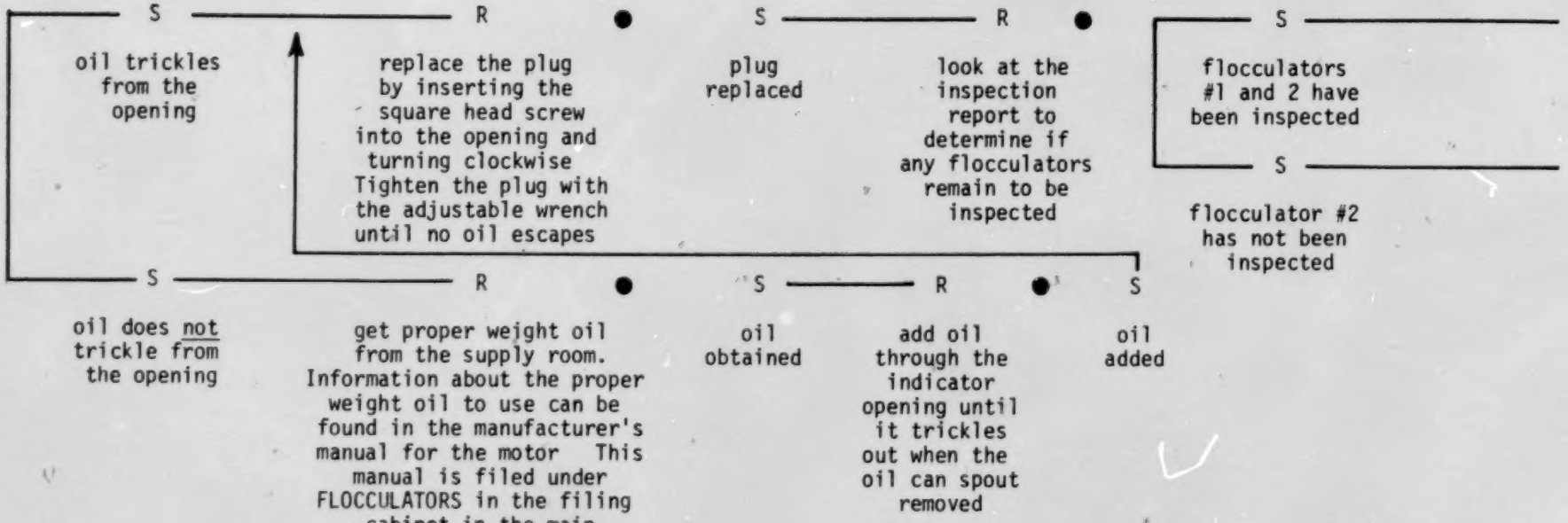
remove the plug by turning the screw counter-clockwise with an adjustable wrench

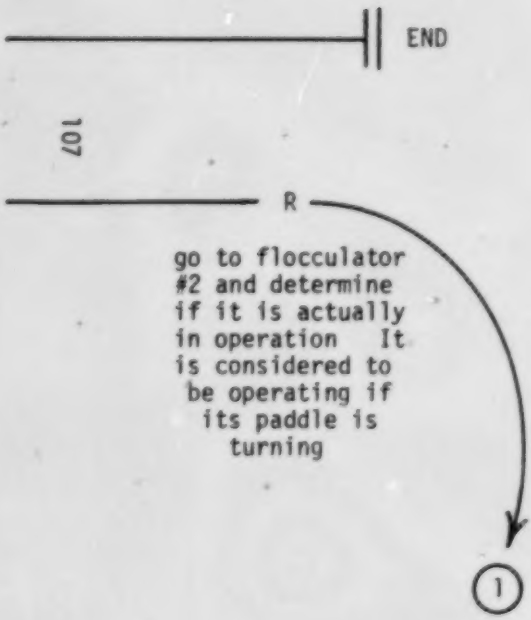
S — R

plug removed

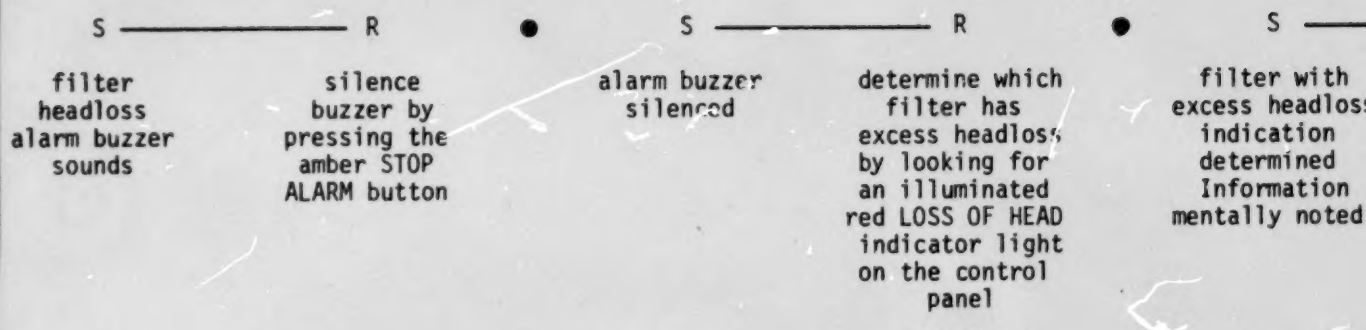
look at the opening to see if any oil trickles out

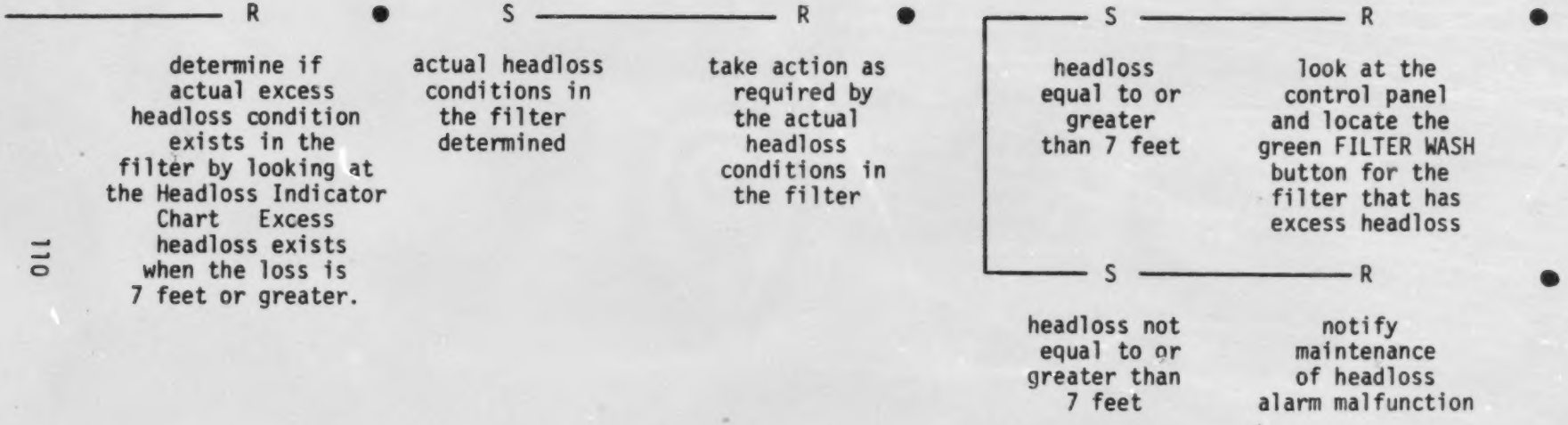
116


106
S
R
oil trickles from the opening
replace the plug by inserting the square head screw into the opening and turning clockwise Tighten the plug with the adjustable wrench until no oil escapes
S
R
plug replaced
look at the inspection report to determine if any flocculators remain to be inspected
S
flocculators #1 and 2 have been inspected
S
flocculator #2 has not been inspected
S
R
oil does not trickle from the opening
get proper weight oil from the supply room. Information about the proper weight oil to use can be found in the manufacturer's manual for the motor This manual is filed under FLOCCULATORS in the filing cabinet in the main control room.
S
R
oil obtained
add oil through the indicator opening until it trickles out when the oil can spout removed
S
oil added

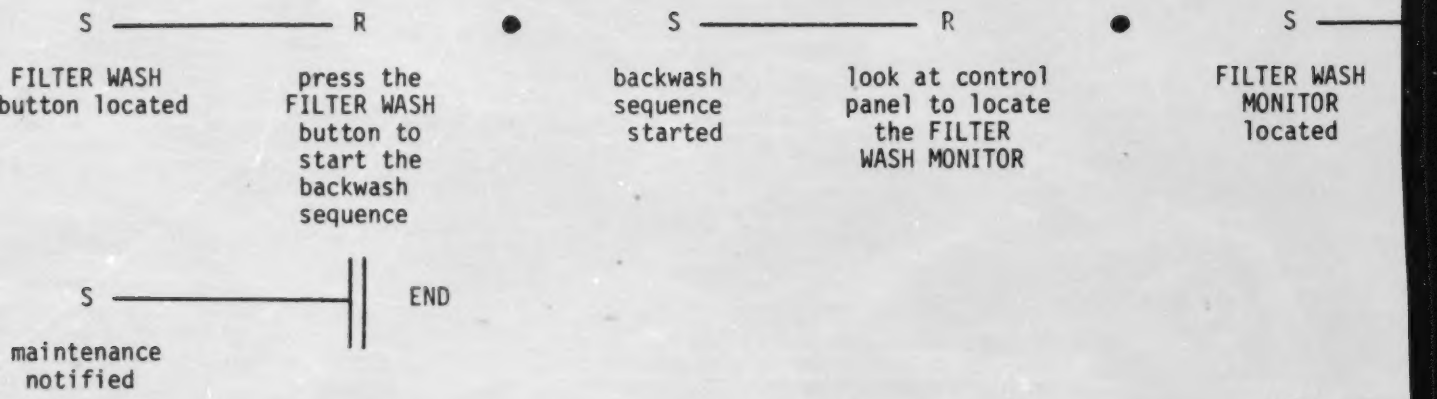

END
107
R
go to flocculator #2 and determine if it is actually in operation It is considered to be operating if its paddle is turning
1

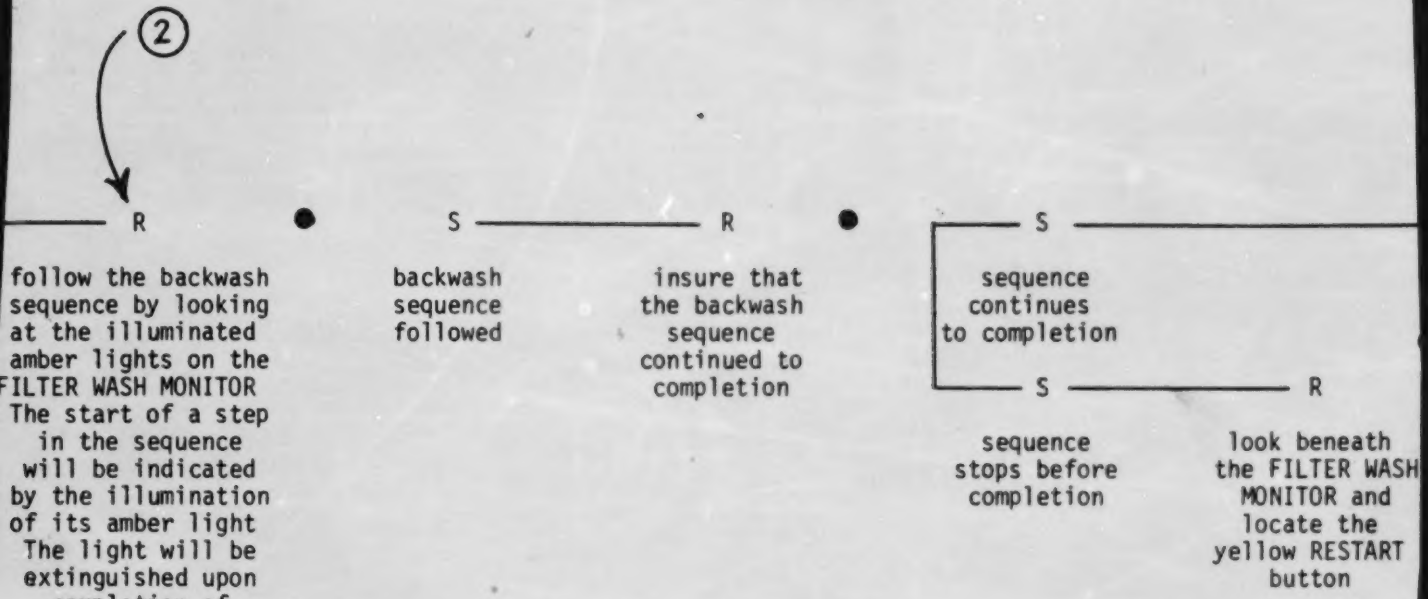
RAPID SAND FILTERS
FLOW PRESCRIPTION

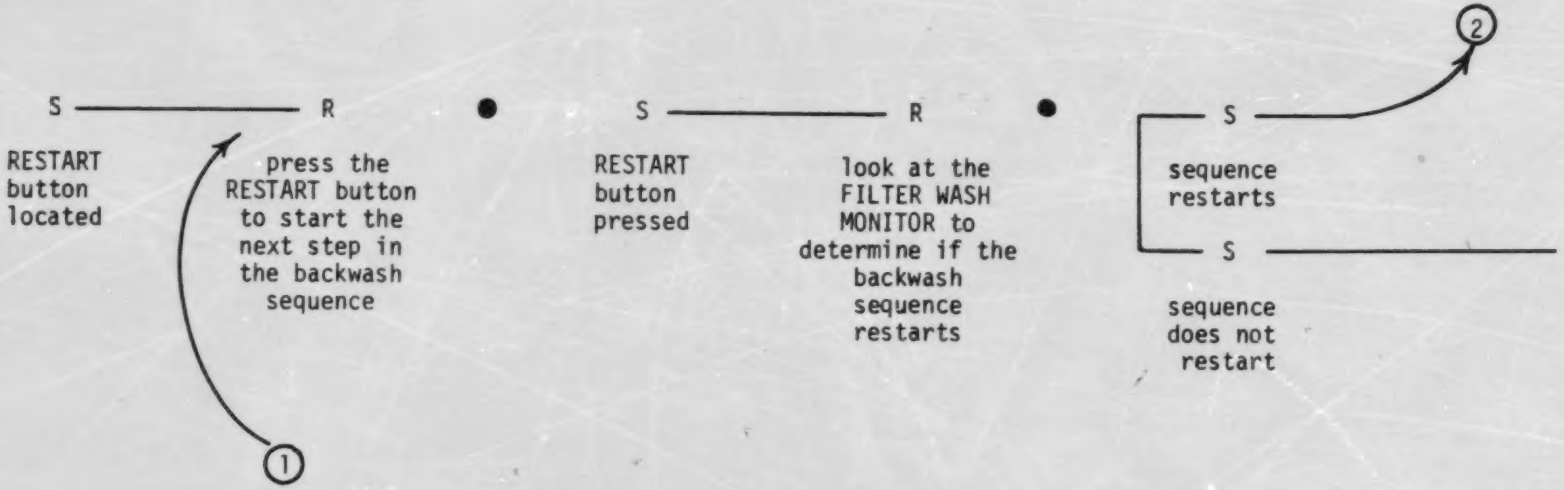

S
R
filter headloss alarm buzzer sounds
silence buzzer by pressing the amber STOP ALARM button
S
R
alarm buzzer silenced
determine which filter has excess headloss by looking for an illuminated red LOSS OF HEAD indicator light on the control panel
S
filter with excess headloss indication determined
Information mentally noted

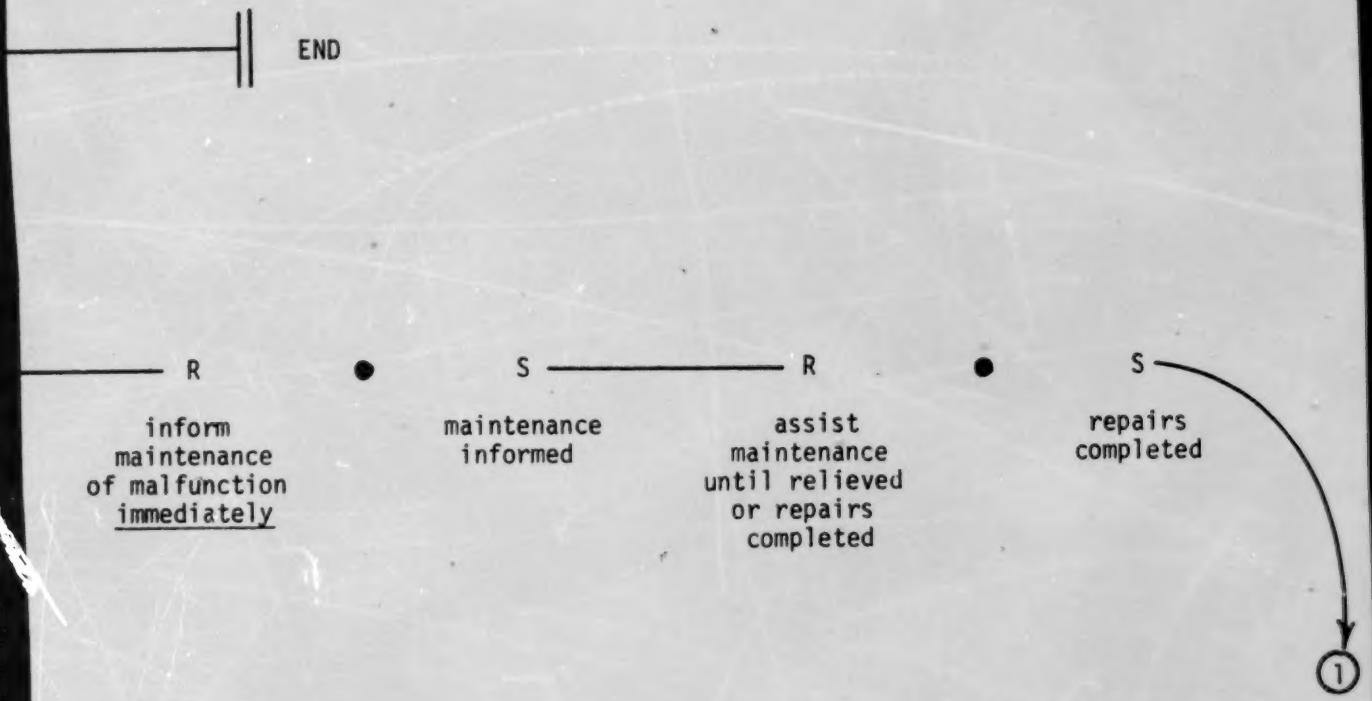

R
determine if actual excess headloss condition exists in the filter by looking at the Headloss Indicator Chart Excess headloss exists when the loss is 7 feet or greater.
S
actual headloss conditions in the filter determined
R
take action as required by the actual headloss conditions in the filter
S
headloss equal to or greater than 7 feet
R
look at the control panel and locate the green FILTER WASH button for the filter that has excess headloss
S
headloss not equal to or greater than 7 feet
R
notify maintenance of headloss alarm malfunction

110


S
R
FILTER WASH button located
press the FILTER WASH button to start the backwash sequence
S
R
backwash sequence started
look at control panel to locate the FILTER WASH MONITOR
S
FILTER WASH MONITOR located
S
END
maintenance notified


2
R
follow the backwash sequence by looking at the illuminated amber lights on the FILTER WASH MONITOR The start of a step in the sequence will be indicated by the illumination of its amber light The light will be extinguished upon completion of the step.
S
R
backwash sequence followed
insure that the backwash sequence continued to completion
S
sequence continues to completion
S
R
sequence stops before completion
look beneath the FILTER WASH MONITOR and locate the yellow RESTART button


S
R
RESTART button located
press the RESTART button to start the next step in the backwash sequence
1
S
R
RESTART button pressed
look at the FILTER WASH MONITOR to determine if the backwash sequence restarts
S
sequence restarts
2
S
sequence does not restart


END
R
inform maintenance of malfunction immediately
S
maintenance informed
R
assist maintenance until relieved or repairs completed
S
repairs completed
1

FINISHED WATER SERVICE SYSTEM
FLOW PRESCRIPTION

S	R
routine inspection of the finished water service pumping automatic control system required	look at the Elevated Storage Tank Water Level Indicator on the control panel and start the inspection when the tank is being filled The tank is being filled when the water level indicator shows the water level in the tank is rising.

S	R
the tank is being filled	on the inspection report note if service pump #1 or #2 is operating

S
informatio noted

R ●

when the water level in the elevated storage tank reaches 35', look at the control panel and from the illuminated lights determine if the automatic controller shuts down the service pump that was operating The pump is shut down when its green ON light is extinguished and its red OFF light is illuminated

S

the pump is automatically shut down

S — R ●

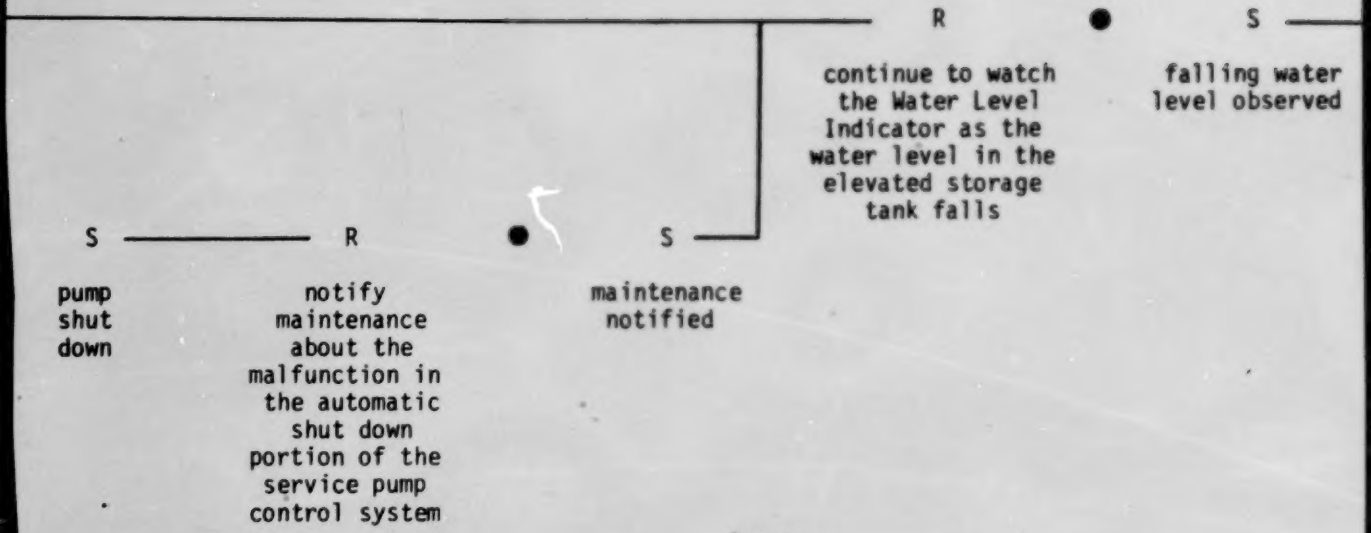
the pump is not automatically shut down

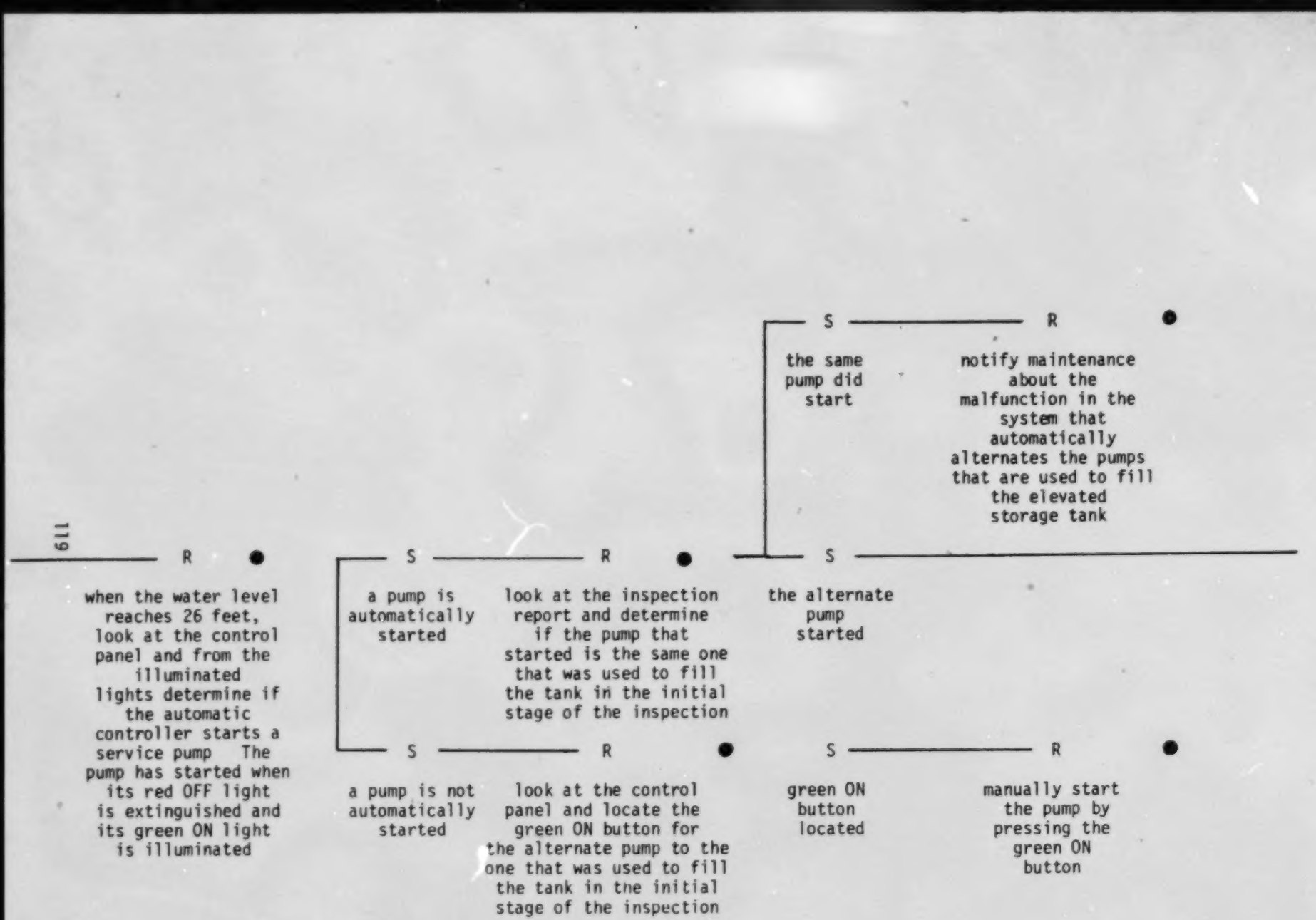
look at the control panel and locate the red OFF button for the service pump that is operating

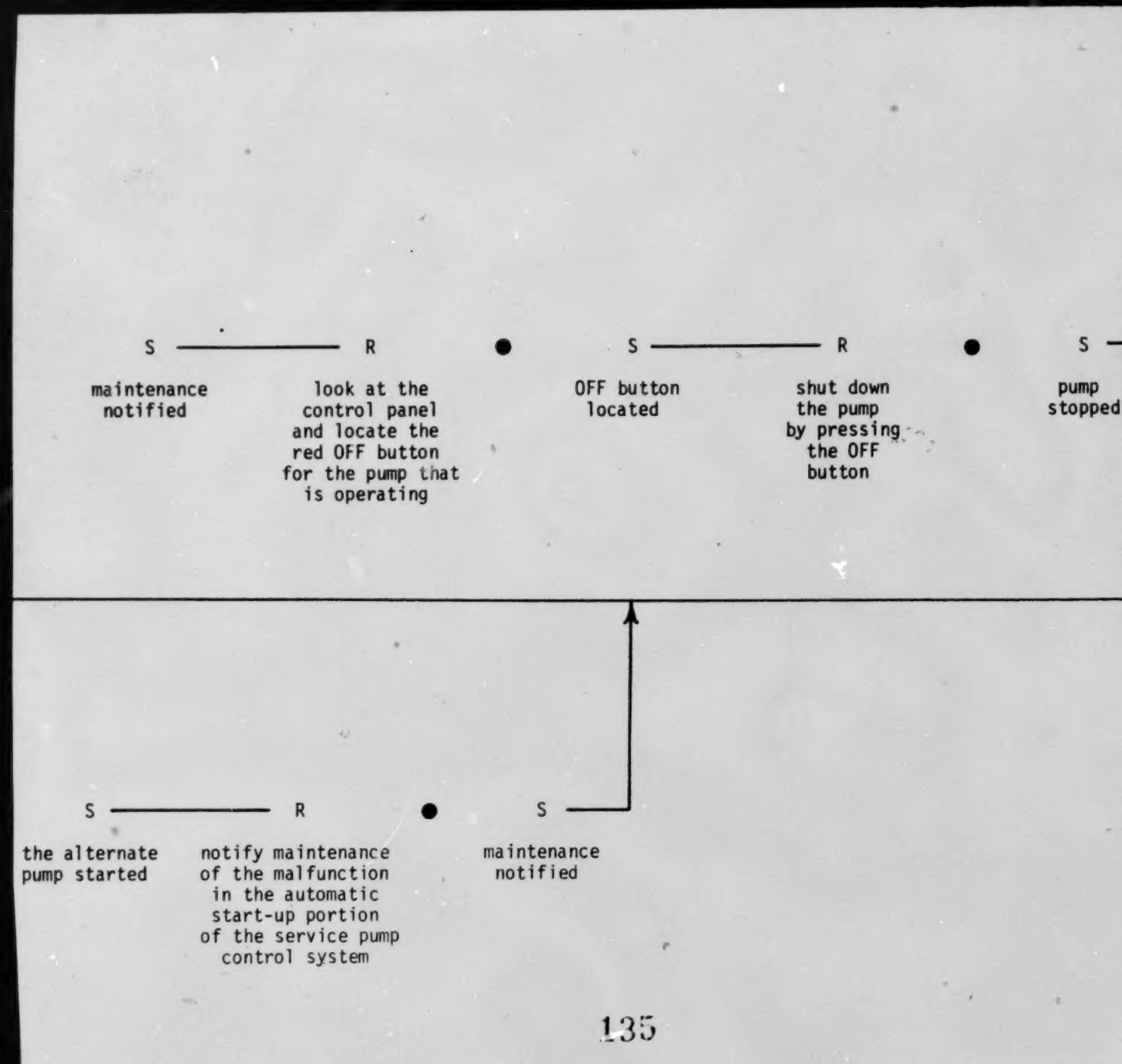
S — R

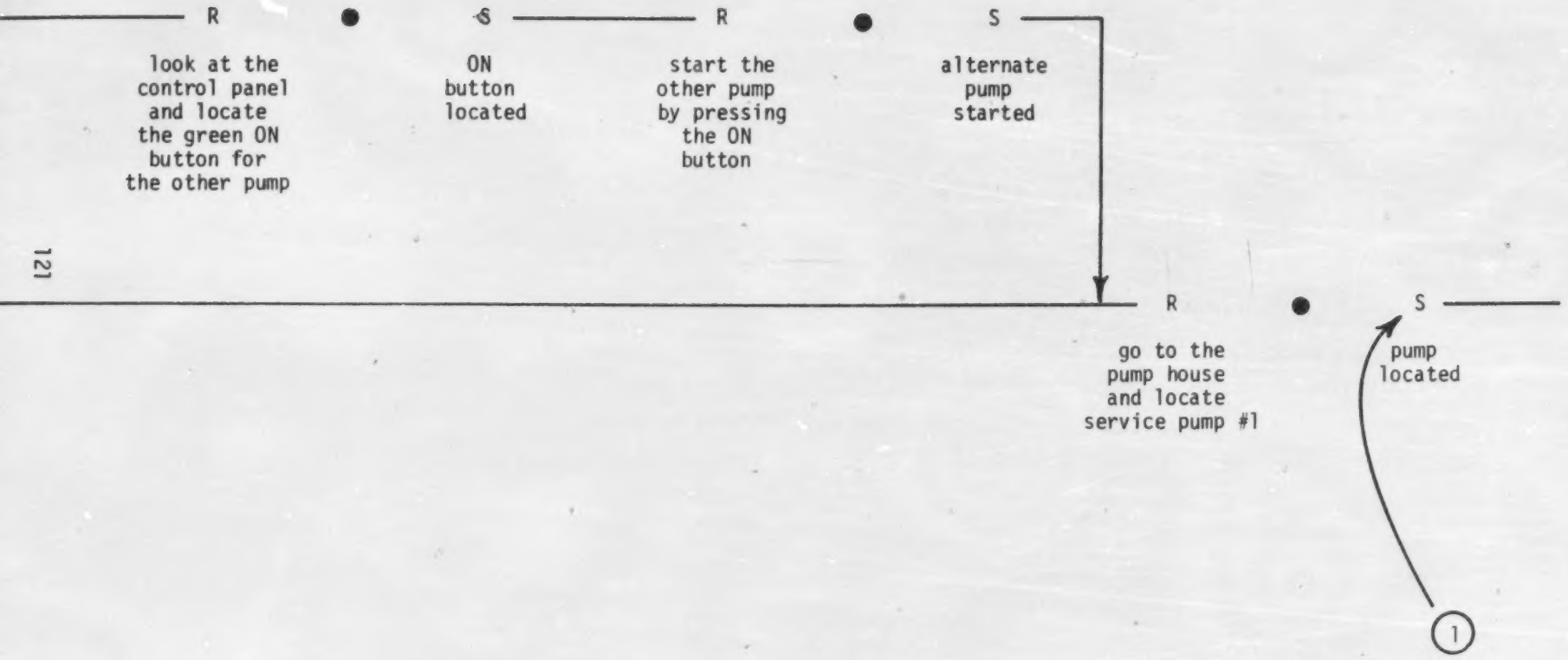
OFF button located

manually shut down the pump by pressing the OFF button


R
S
continue to watch the Water Level Indicator as the water level in the elevated storage tank falls
falling water level observed
S
R
S
pump shut down
notify maintenance about the malfunction in the automatic shut down portion of the service pump control system
maintenance notified


119
R
when the water level reaches 26 feet, look at the control panel and from the illuminated lights determine if the automatic controller starts a service pump The pump has started when its red OFF light is extinguished and its green ON light is illuminated
S
R
a pump is automatically started
look at the inspection report and determine if the pump that started is the same one that was used to fill the tank in the initial stage of the inspection
S
R
a pump is not automatically started
look at the control panel and locate the green ON button for the alternate pump to the one that was used to fill the tank in the initial stage of the inspection
S
R
the same pump did start
notify maintenance about the malfunction in the system that automatically alternates the pumps that are used to fill the elevated storage tank
S
the alternate pump started
S
R
green ON button located
manually start the pump by pressing the green ON button


S
R
maintenance notified
look at the control panel and locate the red OFF button for the pump that is operating
S
R
OFF button located
shut down the pump by pressing the OFF button
S
pump stopped
S
R
the alternate pump started
notify maintenance of the malfunction in the automatic start-up portion of the service pump control system
S
maintenance notified


R
look at the control panel and locate the green ON button for the other pump
S
ON button located
R
start the other pump by pressing the ON button
S
alternate pump started
121
R
go to the pump house and locate service pump #1
S
pump located
1

122

R

locate the oil level indicator window on the upper left side of the pump motor

S — R

oil level indicator window located

look at the oil level and determine if the oil is above or below the fill line

S

the oil level is above the fill line

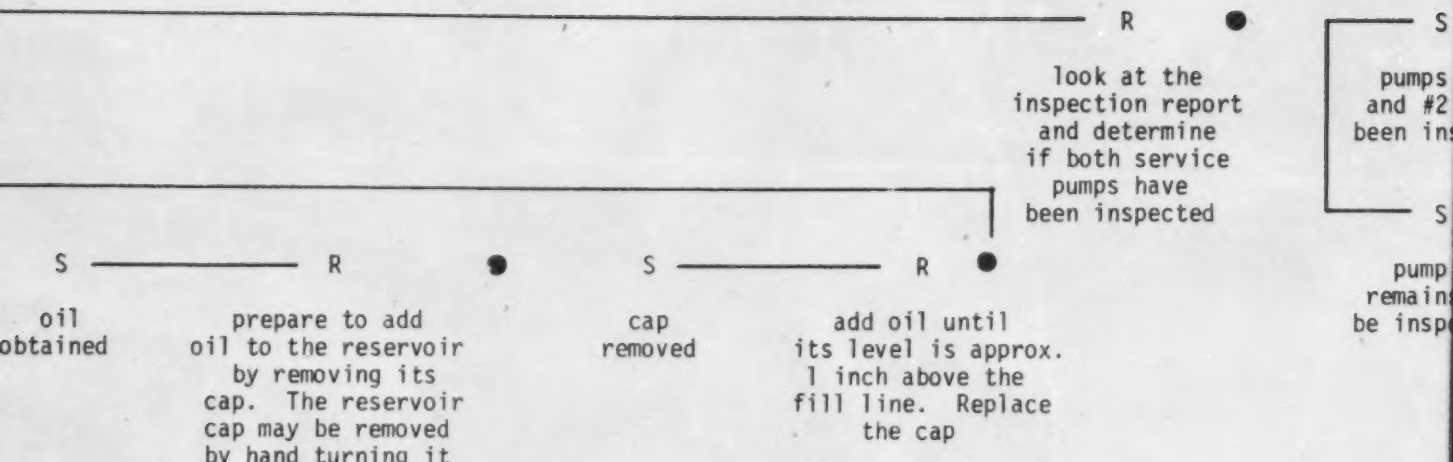
S — R

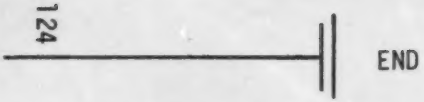
the oil level is below the fill line

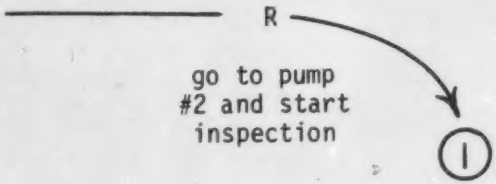
get the proper weight oil from the supply room. Information about the weight of oil to use can be found in the manufacturer's manual for the pump This manual is filed under SERVICE PUMPS in the filing cabinet in the main control room

133

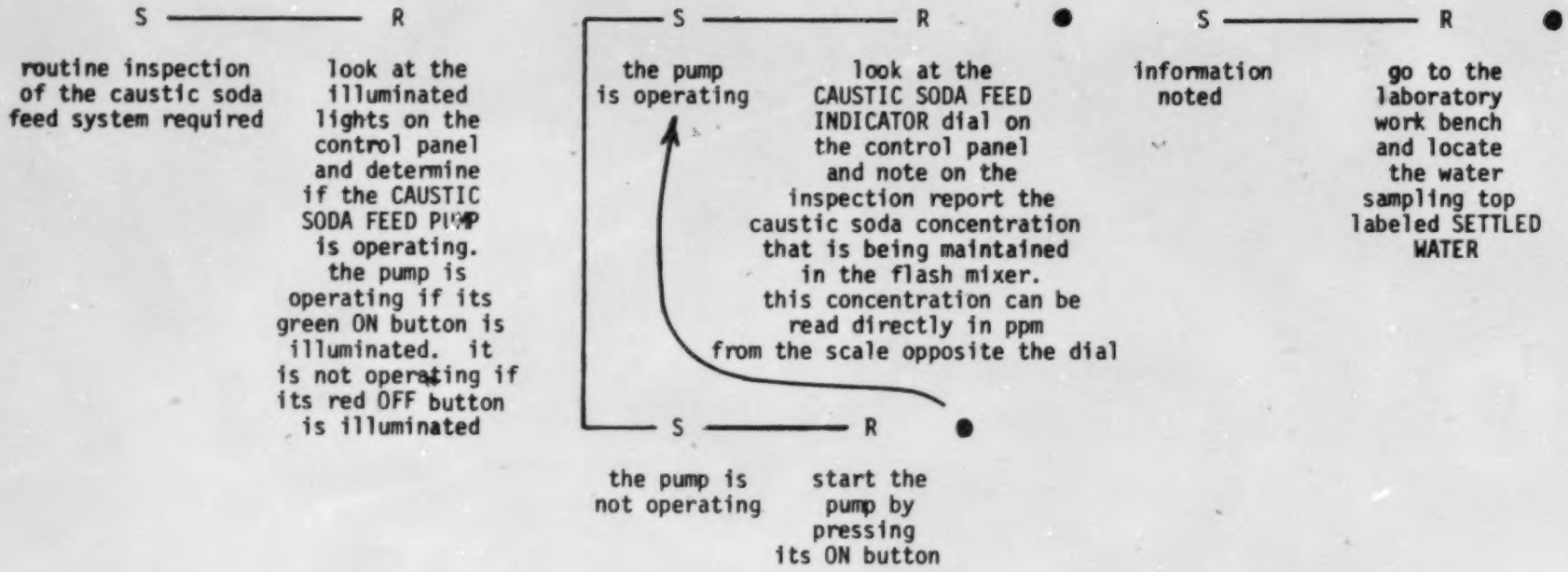
139


R
look at the inspection report and determine if both service pumps have been inspected
S
pumps and #2 been ins
S
pump remain be insp
S
R
oil obtained
prepare to add oil to the reservoir by removing its cap. The reservoir cap may be removed by hand turning it counter-clockwise
S
R
cap removed
add oil until its level is approx. 1 inch above the fill line. Replace the cap

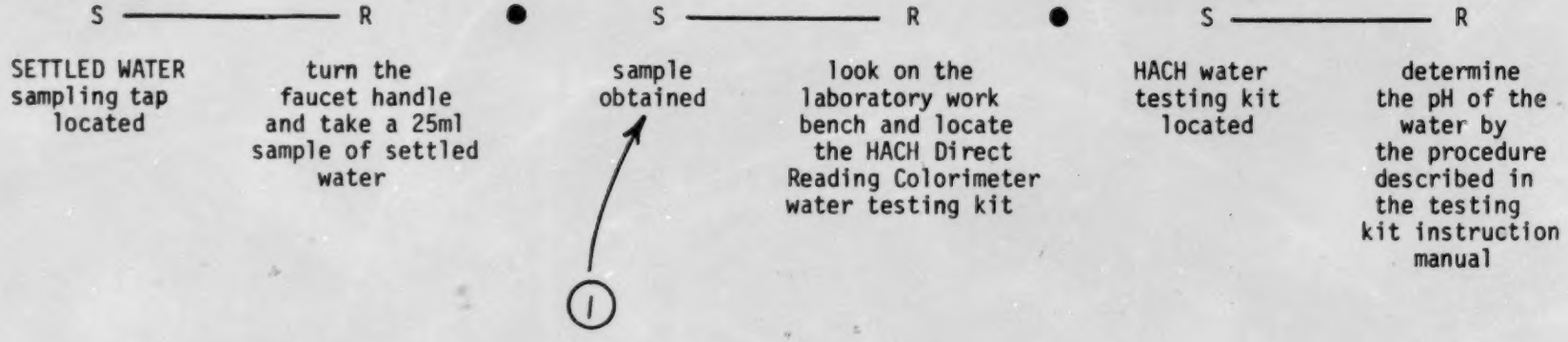

124
END


R
go to pump
#2 and start
inspection
1

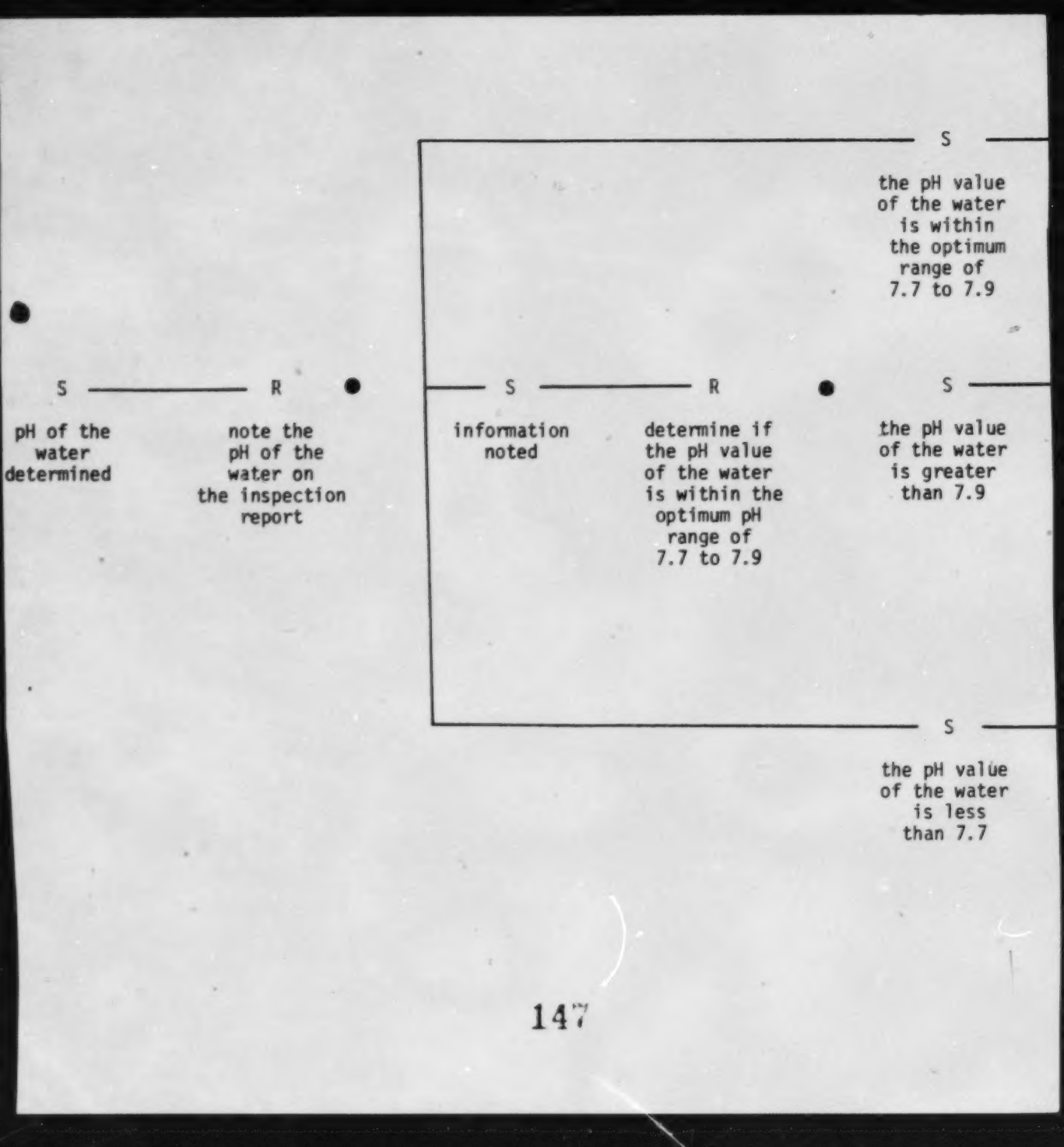
CAUSTIC SODA FEED SYSTEM
FLOW PRESCRIPTION

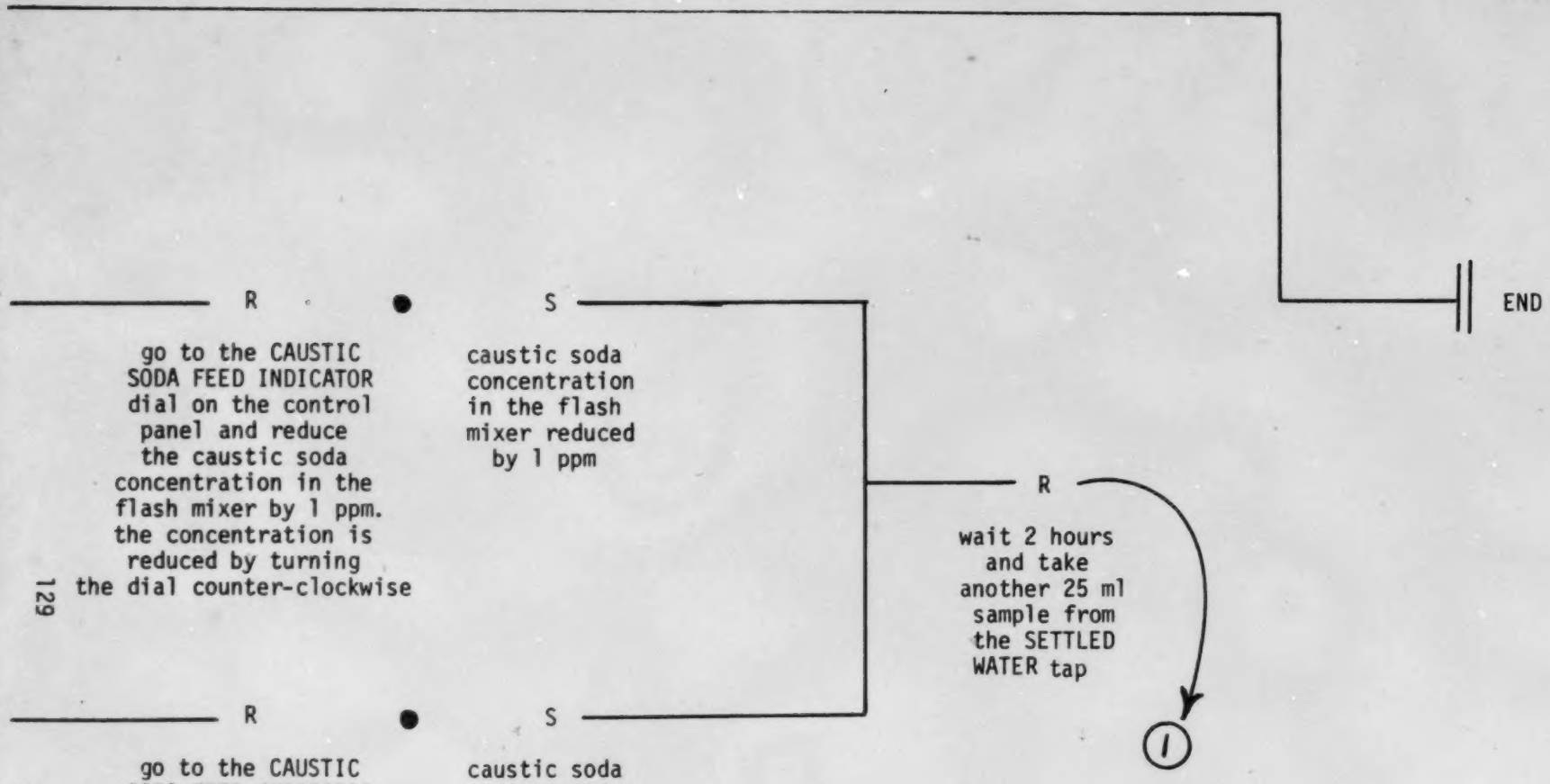

S
R
routine inspection of the caustic soda feed system required
look at the illuminated lights on the control panel and determine if the CAUSTIC SODA FEED PUMP is operating. the pump is operating if its green ON button is illuminated. it is not operating if its red OFF button is illuminated
S
R
the pump is operating
look at the CAUSTIC SODA FEED INDICATOR dial on the control panel and note on the inspection report the caustic soda concentration that is being maintained in the flash mixer. this concentration can be read directly in ppm from the scale opposite the dial
S
R
the pump is not operating
start the pump by pressing its ON button
S
R
information noted
go to the laboratory work bench and locate the water sampling top labeled SETTLED WATER

126


S
R
SETTLED WATER sampling tap located
turn the faucet handle and take a 25ml sample of settled water
S
R
sample obtained
look on the laboratory work bench and locate the HACH Direct Reading Colorimeter water testing kit
S
R
HACH water testing kit located
determine the pH of the water by the procedure described in the testing kit instruction manual
1

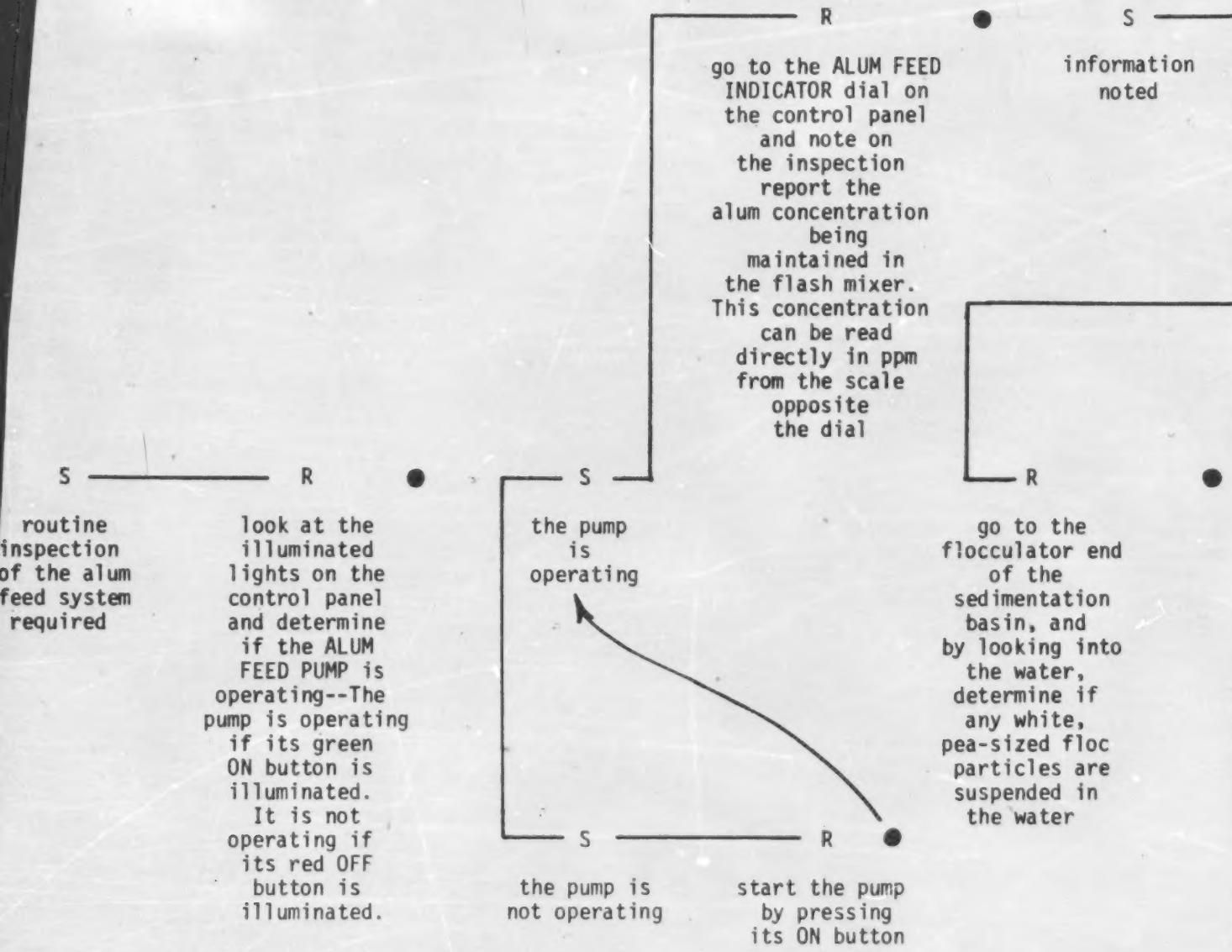
127

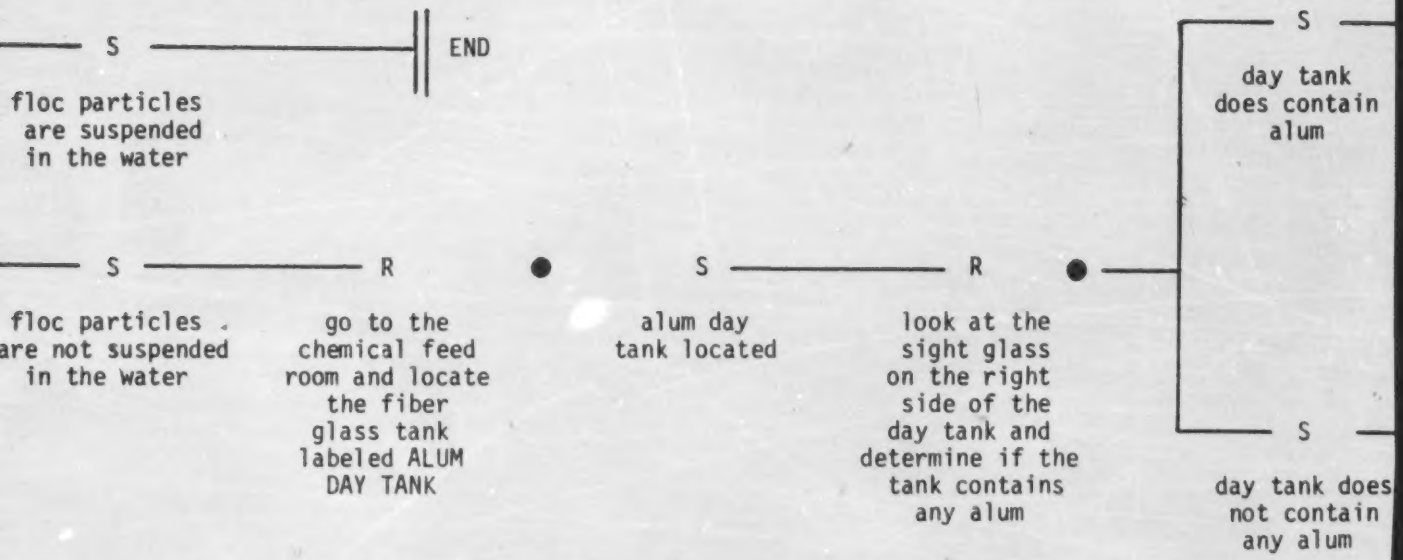

S
pH of the water determined
R
note the pH of the water on the inspection report
S
information noted
R
determine if the pH value of the water is within the optimum pH range of 7.7 to 7.9
S
the pH value of the water is greater than 7.9
S
the pH value of the water is within the optimum range of 7.7 to 7.9
S
the pH value of the water is less than 7.7

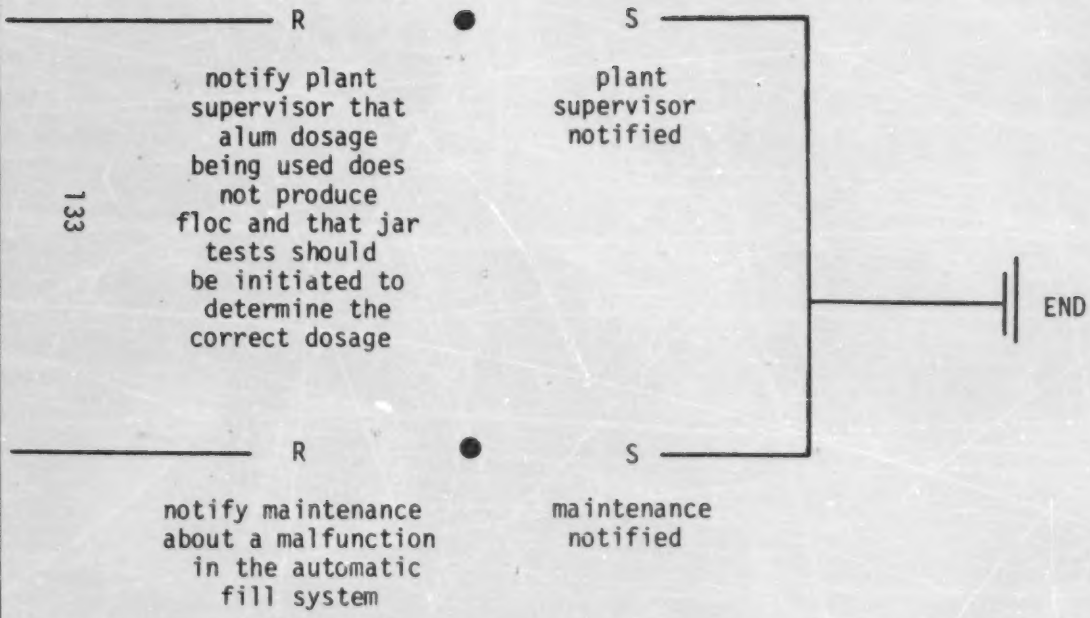

END
R
S
go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and reduce the caustic soda concentration in the flash mixer by 1 ppm. the concentration is reduced by turning the dial counter-clockwise
caustic soda concentration in the flash mixer reduced by 1 ppm
R
wait 2 hours and take another 25 ml sample from the SETTLED WATER tap
1
R
S
go to the CAUSTIC SODA FEED INDICATOR dial on the control panel and increase the caustic soda concentration in the flash mixer by 1 ppm. the concentration is increased by turning the dial clockwise
caustic soda concentration in the flash mixer increased by 1 ppm

129

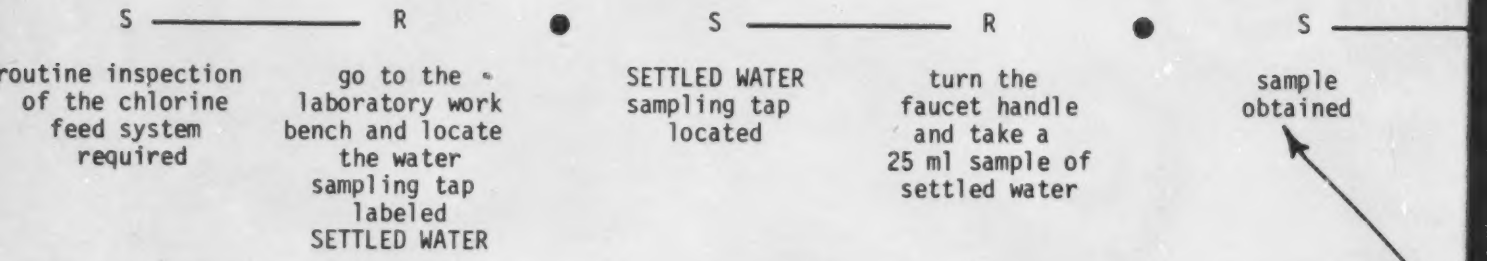
ALUM FEED SYSTEM
FLOW PRESCRIPTION


S
routine inspection of the alum feed system required
R
look at the illuminated lights on the control panel and determine if the ALUM FEED PUMP is operating--The pump is operating if its green ON button is illuminated. It is not operating if its red OFF button is illuminated.
S
the pump is operating
R
go to the ALUM FEED INDICATOR dial on the control panel and note on the inspection report the alum concentration being maintained in the flash mixer. This concentration can be read directly in ppm from the scale opposite the dial
S
information noted
R
go to the flocculator end of the sedimentation basin, and by looking into the water, determine if any white, pea-sized floc particles are suspended in the water
S
the pump is not operating
R
start the pump by pressing its ON button


S
END
floc particles are suspended in the water
S
R
floc particles are not suspended in the water
go to the chemical feed room and locate the fiber glass tank labeled ALUM DAY TANK
S
R
alum day tank located
look at the sight glass on the right side of the day tank and determine if the tank contains any alum
S
day tank does contain alum
S
day tank does not contain any alum


R
S
notify plant supervisor that alum dosage being used does not produce floc and that jar tests should be initiated to determine the correct dosage
plant supervisor notified
133
END
R
S
notify maintenance about a malfunction in the automatic fill system
maintenance notified

CHLORINATION SYSTEM
FLOW PRESCRIPTION


S
R
routine inspection of the chlorine feed system required
go to the laboratory work bench and locate the water sampling tap labeled SETTLED WATER
S
R
SETTLED WATER sampling tap located
turn the faucet handle and take a 25 ml sample of settled water
S
sample obtained

R

look on the laboratory work bench and locate the HACH Direct Reading Colorimeter water testing kit

S — R

water testing kit located

determine the chlorine concentration in the water by the procedure described in the testing kit instruction manual

S — R

chlorine concentration in the water determined

note the chlorine concentration on the inspection report

S

information noted

136

R

determine if the chlorine concentration is within the required 0.25 to 0.45 ppm range

S

the chlorine concentration of the water is within the 0.25 to 0.45 ppm range

S — R

the chlorine concentration is greater than 0.45 ppm

go to the chlorinator room and locate the chlorinator labeled PRE-CHLORINATOR

S — R

PRE-CHLORINATOR located

look at the front of the chlorinator and locate the DOSAGE RATE CONTROLLER knob

S — R

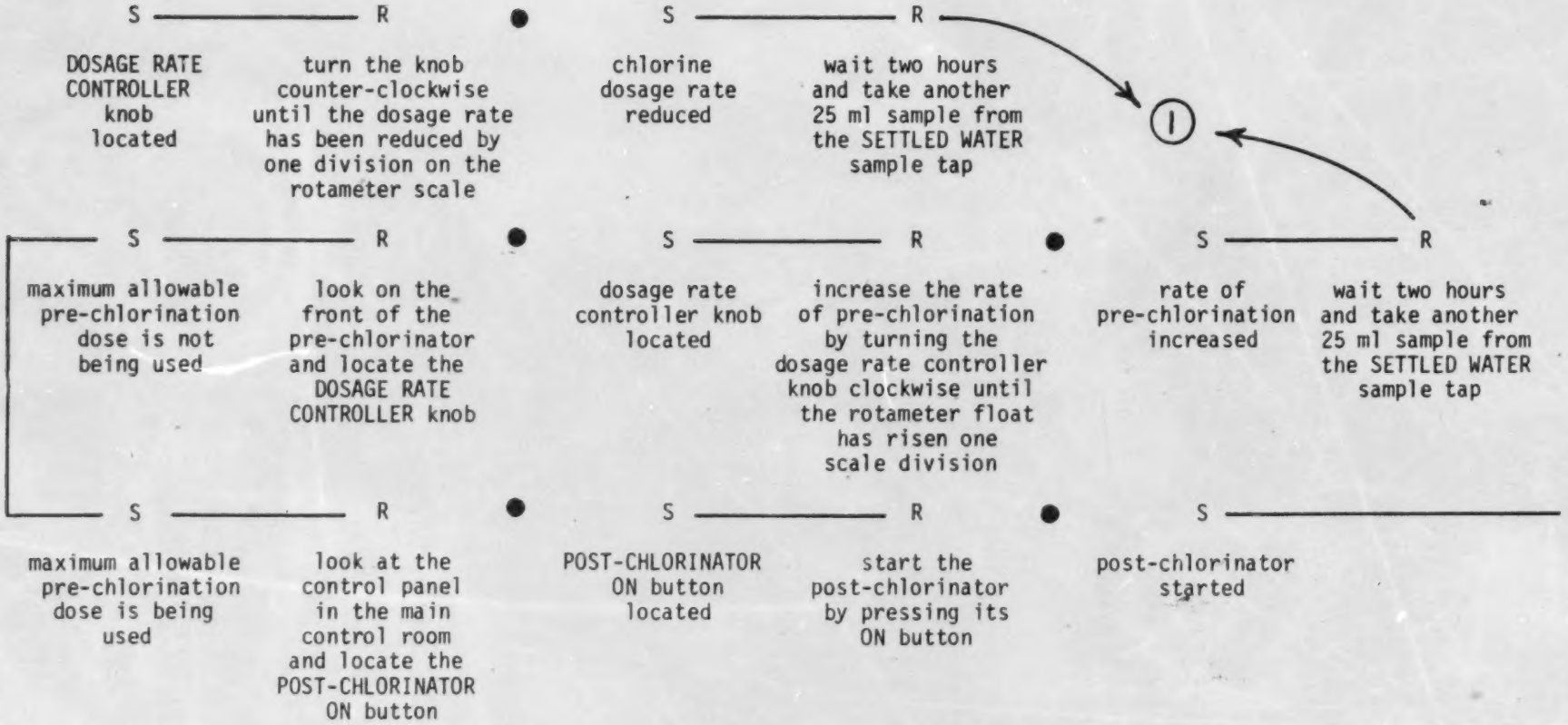
the chlorine concentration is less than 0.25 ppm

go to the chlorinator room and locate the chlorinator labeled PRE-CHLORINATOR

S — R

PRE-CHLORINATOR located

look at the rotameter float indicator and determine if the maximum allowable pre-chlorination dose is being used. The maximum pre-chlorinatio dose is marked on the rotameter scale and is labeled MAX DOSE


S
R
DOSAGE RATE CONTROLLER knob located
turn the knob counter-clockwise until the dosage rate has been reduced by one division on the rotameter scale
chlorine dosage rate reduced
wait two hours and take another 25 ml sample from the SETTLED WATER sample tap
1
maximum allowable pre-chlorination dose is not being used
look on the front of the pre-chlorinator and locate the DOSAGE RATE CONTROLLER knob
dosage rate controller knob located
increase the rate of pre-chlorination by turning the dosage rate controller knob clockwise until the rotameter float has risen one scale division
rate of pre-chlorination increased
wait two hours and take another 25 ml sample from the SETTLED WATER sample tap
maximum allowable pre-chlorination dose is being used
look at the control panel in the main control room and locate the POST-CHLORINATOR ON button
POST-CHLORINATOR ON button located
start the post-chlorinator by pressing its ON button
post-chlorinator started
138

139

R — go to the chlorinator room and locate the POST-CHLORINATOR--The post-chlorinator is located to the right of the pre-chlorinator

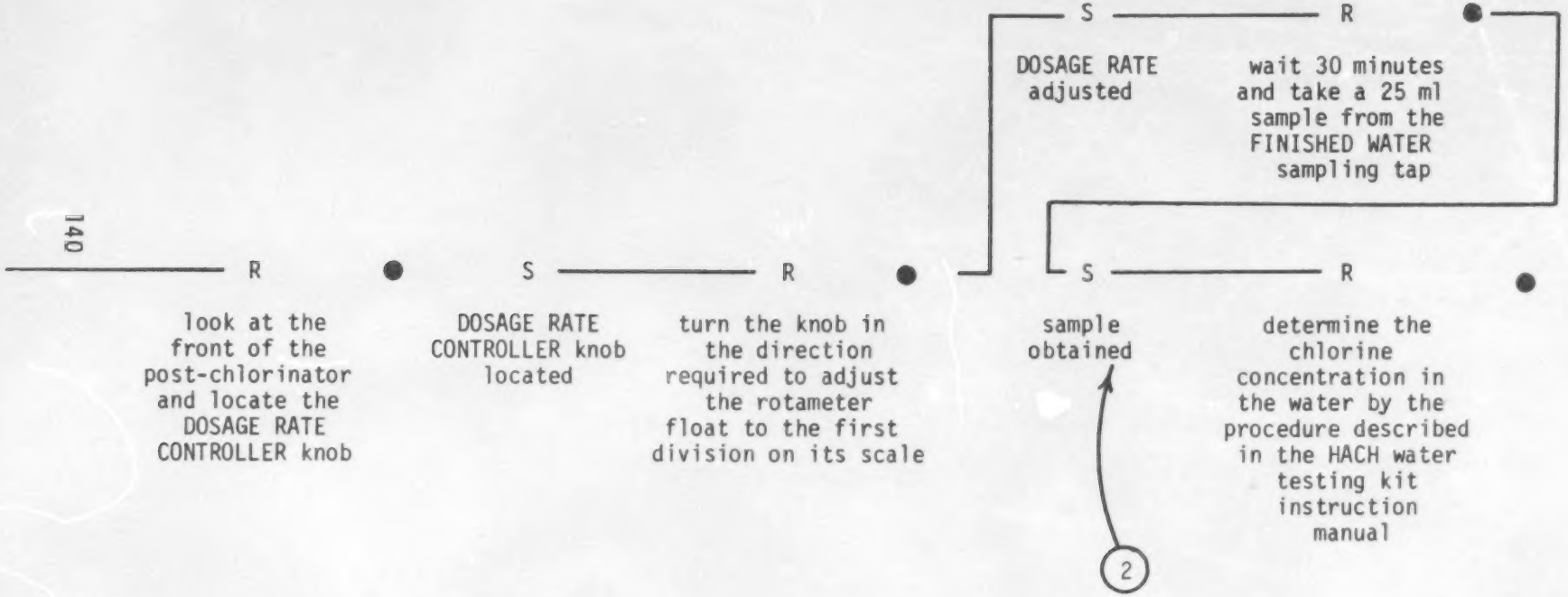
S — post-chlorinator located

R — look behind the post-chlorinator and locate the black-handled valve in the chlorine feed line

S — valve located

R — open the valve by turning the lever handle counter-clockwise until it is parallel to the direction in which the feed line runs

S — valve opened


140
R
look at the front of the post-chlorinator and locate the DOSAGE RATE CONTROLLER knob
S
R
DOSAGE RATE CONTROLLER knob located
turn the knob in the direction required to adjust the rotameter float to the first division on its scale
S
R
DOSAGE RATE adjusted
wait 30 minutes and take a 25 ml sample from the FINISHED WATER sampling tap
S
R
sample obtained
determine the chlorine concentration in the water by the procedure described in the HACH water testing kit instruction manual
2

141

S — R ●

chlorine concentration determined

note the information on the inspection report

S — R ●

information noted

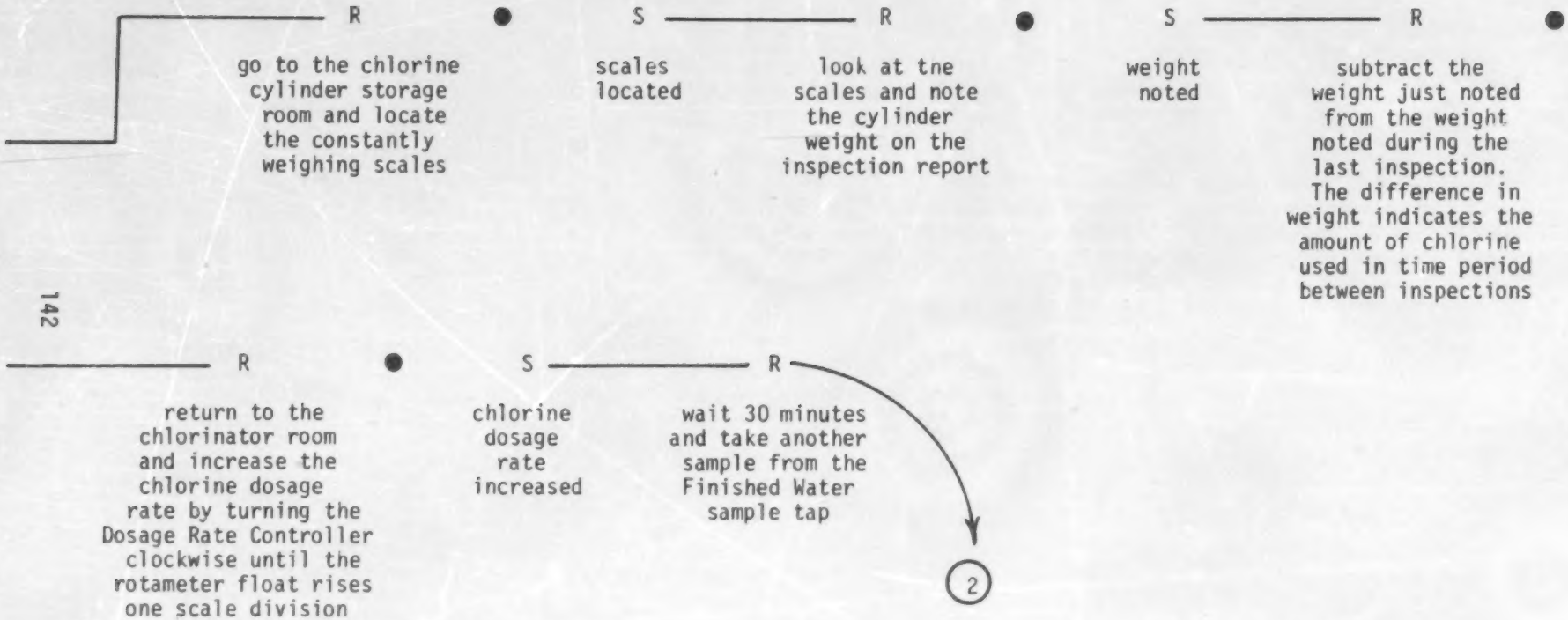
determine if the chlorine concentration in the finished water is within the required 0.25 to 0.45 ppm range

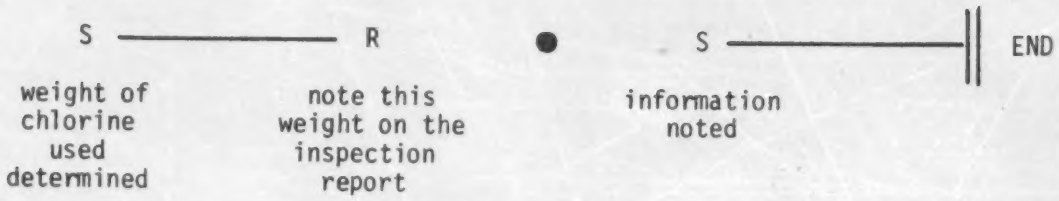
S

chlorine concentration is within the 0.25 to 0.45 ppm range

S

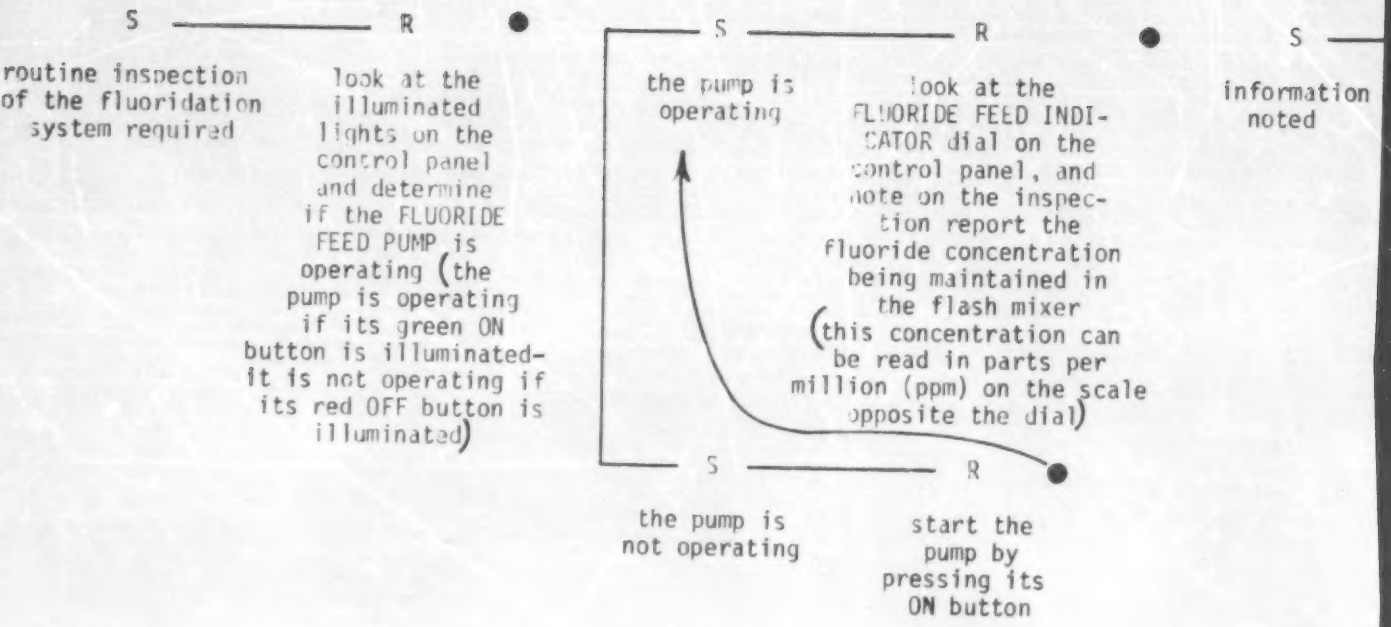
chlorine concentration is still below 0.25 ppm

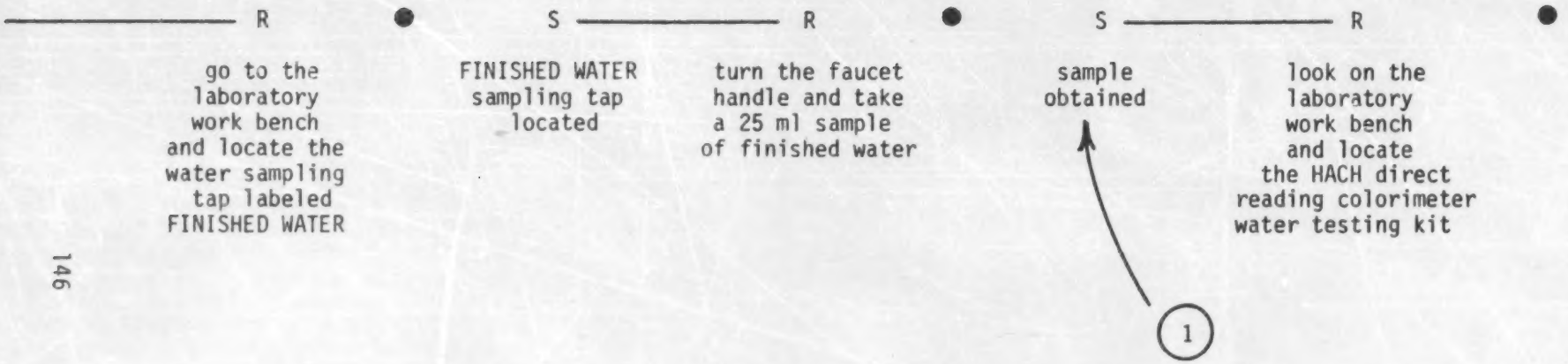

R
go to the chlorine cylinder storage room and locate the constantly weighing scales
S
scales located
R
look at tne scales and note the cylinder weight on the inspection report
S
weight noted
R
subtract the weight just noted from the weight noted during the last inspection. The difference in weight indicates the amount of chlorine used in time period between inspections
142
R
return to the chlorinator room and increase the chlorine dosage rate by turning the Dosage Rate Controller clockwise until the rotameter float rises one scale division
S
chlorine dosage rate increased
R
wait 30 minutes and take another sample from the Finished Water sample tap
2


S
R
S
END
weight of chlorine used determined
note this weight on the inspection report
information noted

143

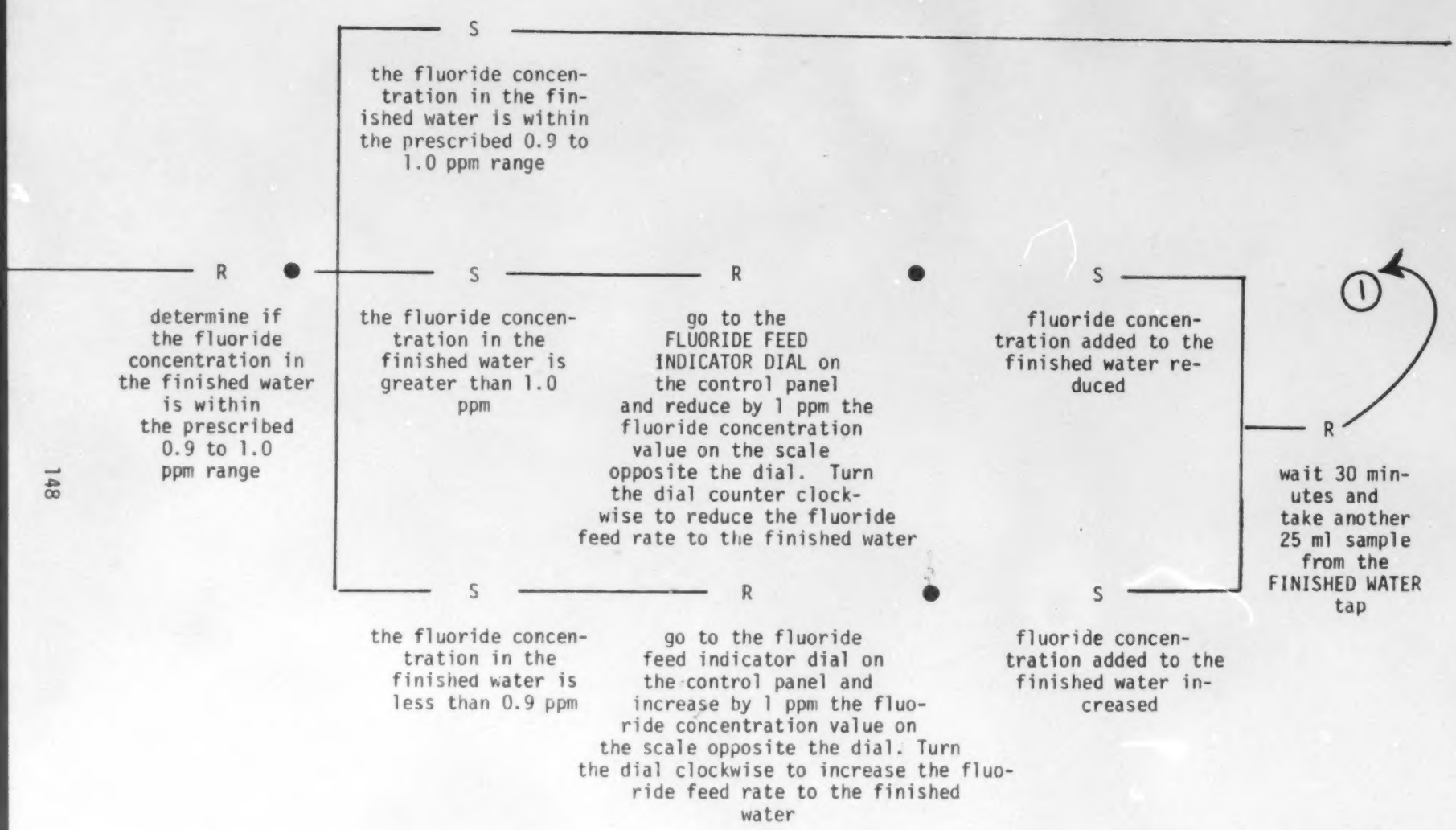
FLUORIDATION SYSTEM
FLOW PRESCRIPTION


S
R
routine inspection of the fluoridation system required
look at the illuminated lights on the control panel and determine if the FLUORIDE FEED PUMP is operating (the pump is operating if its green ON button is illuminated-it is not operating if its red OFF button is illuminated)
S
R
the pump is operating
look at the FLUORIDE FEED INDICATOR dial on the control panel, and note on the inspection report the fluoride concentration being maintained in the flash mixer (this concentration can be read in parts per million (ppm) on the scale opposite the dial)
S
R
the pump is not operating
start the pump by pressing its ON button
S
information noted

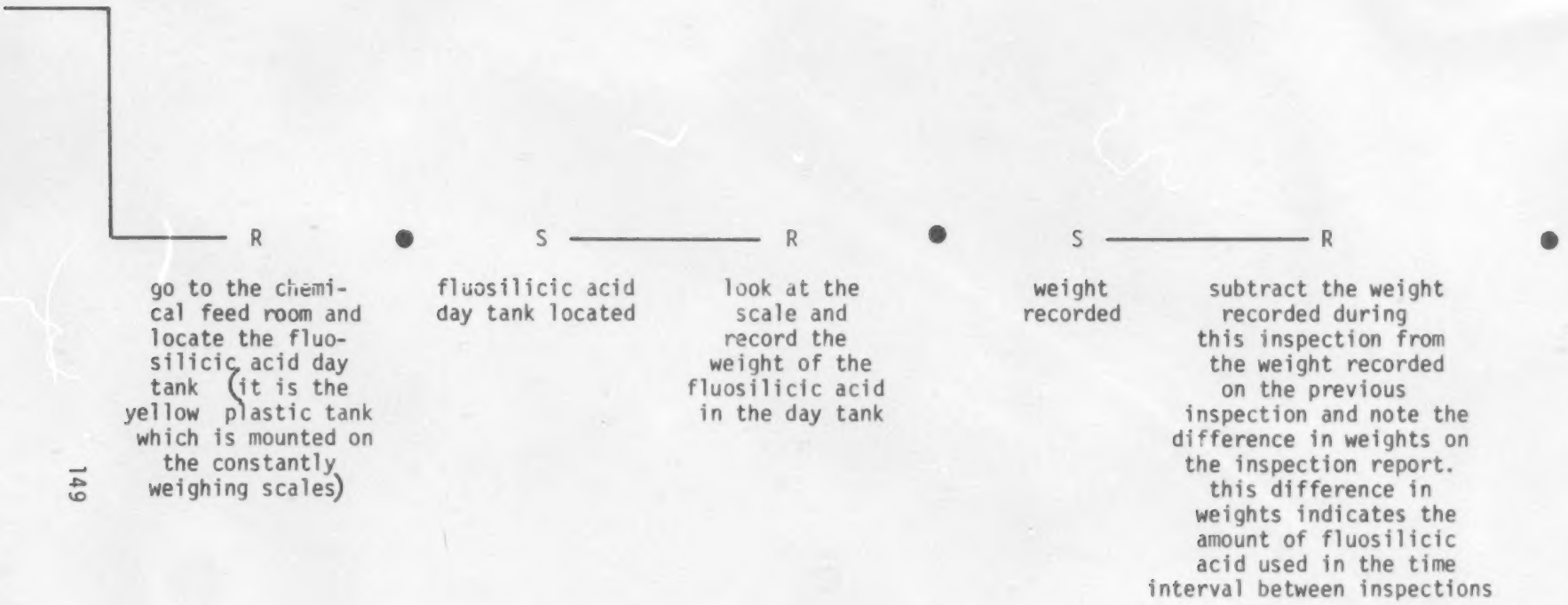

R
go to the laboratory work bench and locate the water sampling tap labeled FINISHED WATER
S
R
FINISHED WATER sampling tap located
turn the faucet handle and take a 25 ml sample of finished water
S
R
sample obtained
look on the laboratory work bench and locate the HACH direct reading colorimeter water testing kit
1

146

S	R	S	R	S
HACH water testing kit located	determine the fluoride concentration in the finished water by the procedure described in the testing kit instruction manual	fluoride concentration in the finished water determined	note the fluoride concentration of the water on the inspection report	information noted


S
the fluoride concentration in the finished water is within the prescribed 0.9 to 1.0 ppm range
R
determine if the fluoride concentration in the finished water is within the prescribed 0.9 to 1.0 ppm range
S
the fluoride concentration in the finished water is greater than 1.0 ppm
R
go to the FLUORIDE FEED INDICATOR DIAL on the control panel and reduce by 1 ppm the fluoride concentration value on the scale opposite the dial. Turn the dial counter clockwise to reduce the fluoride feed rate to the finished water
S
fluoride concentration added to the finished water reduced
1
R
wait 30 minutes and take another 25 ml sample from the FINISHED WATER tap
S
the fluoride concentration in the finished water is less than 0.9 ppm
R
go to the fluoride feed indicator dial on the control panel and increase by 1 ppm the fluoride concentration value on the scale opposite the dial. Turn the dial clockwise to increase the fluoride feed rate to the finished water
S
fluoride concentration added to the finished water increased

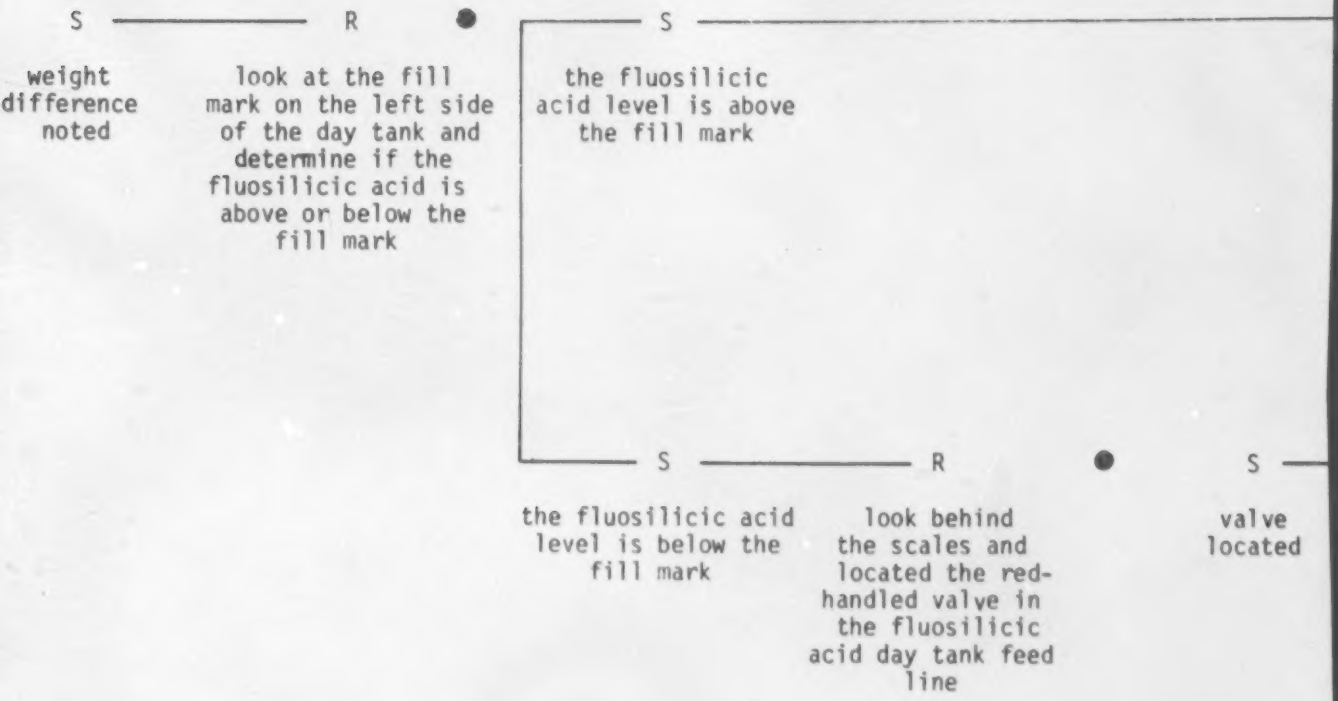
148

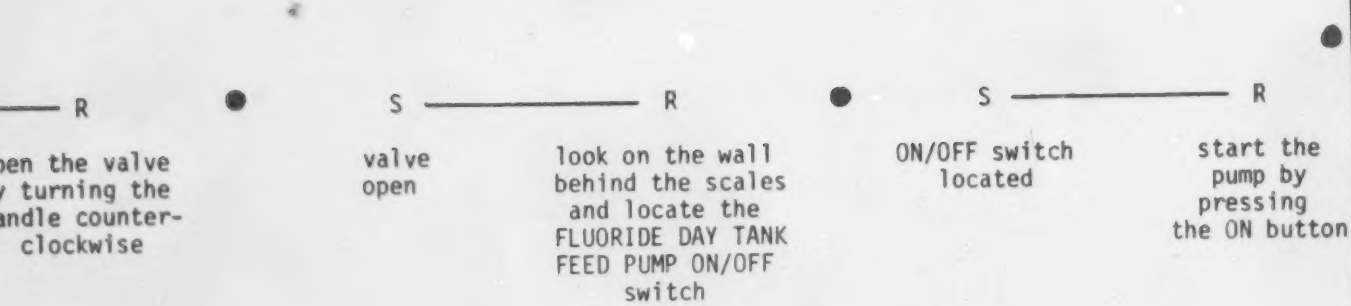

R
go to the chemical feed room and locate the fluosilicic acid day tank (it is the yellow plastic tank which is mounted on the constantly weighing scales)
S
R
fluosilicic acid day tank located
look at the scale and record the weight of the fluosilicic acid in the day tank
S
R
weight recorded
subtract the weight recorded during this inspection from the weight recorded on the previous inspection and note the difference in weights on the inspection report. this difference in weights indicates the amount of fluosilicic acid used in the time interval between inspections

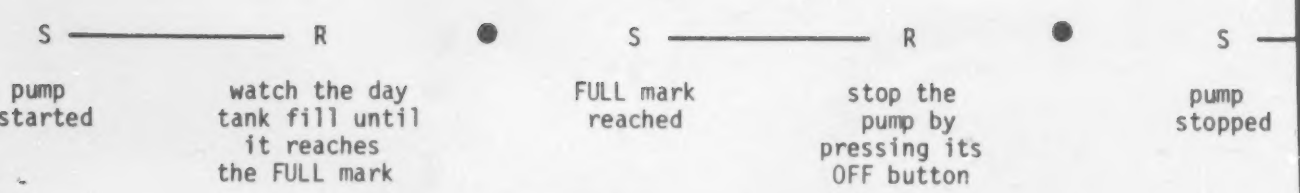
149

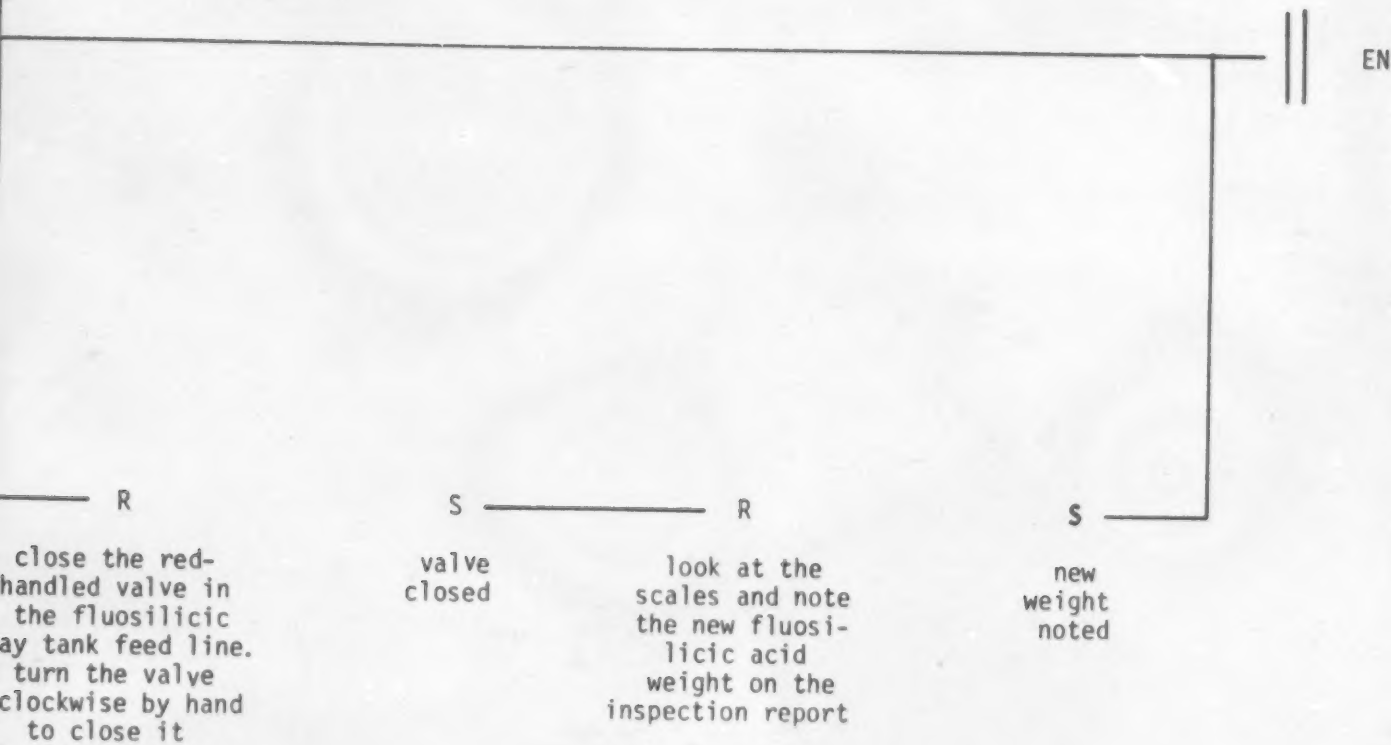
177

178


S
R
weight difference noted
look at the fill mark on the left side of the day tank and determine if the fluosilicic acid is above or below the fill mark
S
the fluosilicic acid level is above the fill mark
S
R
S
the fluosilicic acid level is below the fill mark
look behind the scales and located the red-handled valve in the fluosilicic acid day tank feed line
valve located


R
pen the valve
y turning the
andle counter-
clockwise
S
R
valve
open
look on the wall
behind the scales
and locate the
FLUORIDE DAY TANK
FEED PUMP ON/OFF
switch
S
R
ON/OFF switch
located
start the
pump by
pressing
the ON button


S
R
S
R
S
pump started
watch the day tank fill until it reaches the FULL mark
FULL mark reached
stop the pump by pressing its OFF button
pump stopped


EN
R
close the red-handled valve in the fluosilicic ay tank feed line. turn the valve clockwise by hand to close it
S
valve closed
R
look at the scales and note the new fluosi-licic acid weight on the inspection report
S
new weight noted